USING GIS: FINDING CELL PHONE CALLERS WHEN THERE IS NO ADDRESS

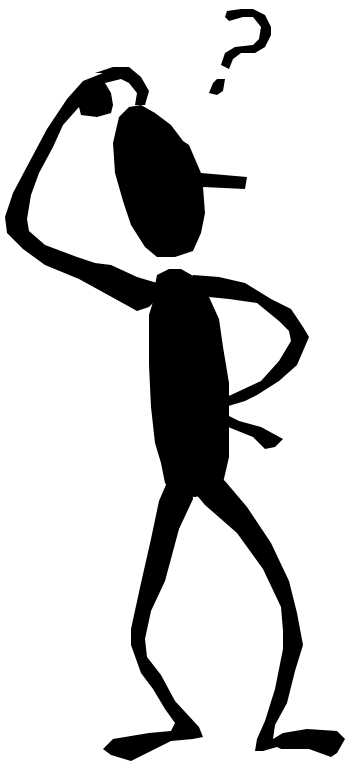
2003 Kentucky Emergency Services Conference

Jim Coffman, Executive Director

Office of Geographic Information

911 location needed for:

Response to emergency –-
Where is it?



Routing of emergency vehicles –-
How to get there?

Tracking of emergency vehicles –-
Who should go and when will they get there?

This presentation will focus on the “where.”

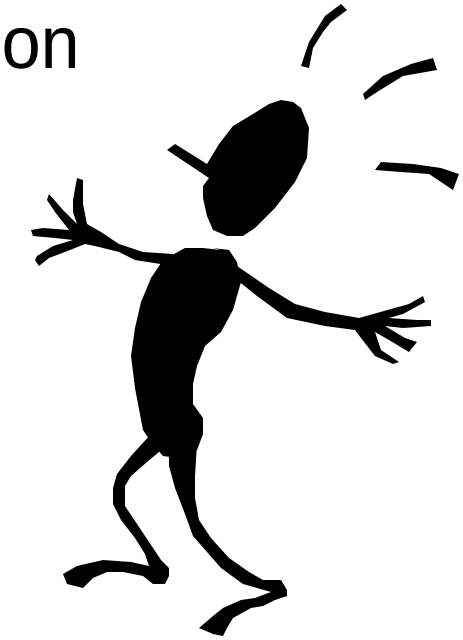
Location can be:

"Absolute" -- latitude/longitude; state plane coordinate system (xy)

"Relative" -- "north side of the road," "on a gravel bar just below the big bend in the river," or "somewhere between Frankfort and Lexington on I-64"

What about addresses-- absolute or relative?

--or maybe some of both?



Location can be determined by:

Asking the caller and/or subscriber identification data --

(in both cases, unless the responder knows from the address where it is and how to get there, reference to a paper or digital map is needed)

and/or

Digital Map Display

(both for land-line and cell phone calls)

This is where GIS comes in . . .

Geographic Information System "**GIS**"

- A system of computer software, hardware, data, processes, and personnel to help manipulate, analyze and present information that is tied to a spatial location

  - "spatial location" – usually a geographic location
  - "information" – visualization of analysis from data
  - "system" – process of linking software, hardware, and data
  - "personnel" – the most important element of a GIS

GIS Coordination in Kentucky

Geographic Information Advisory Council--

GIAC (created in 1994—KRS 11.515 & 11.517)

- Twenty-six member body representing *state* and *local* government and *professional* groups
- *Advises* the CIO and Governor's Office for Technology on GIS issues
- Develops and adopts *policies* and *standards*
- Encourages *coordination* of programs to minimize redundancy
- Promotes *activities* to bring GIS community together (such as annual conference)

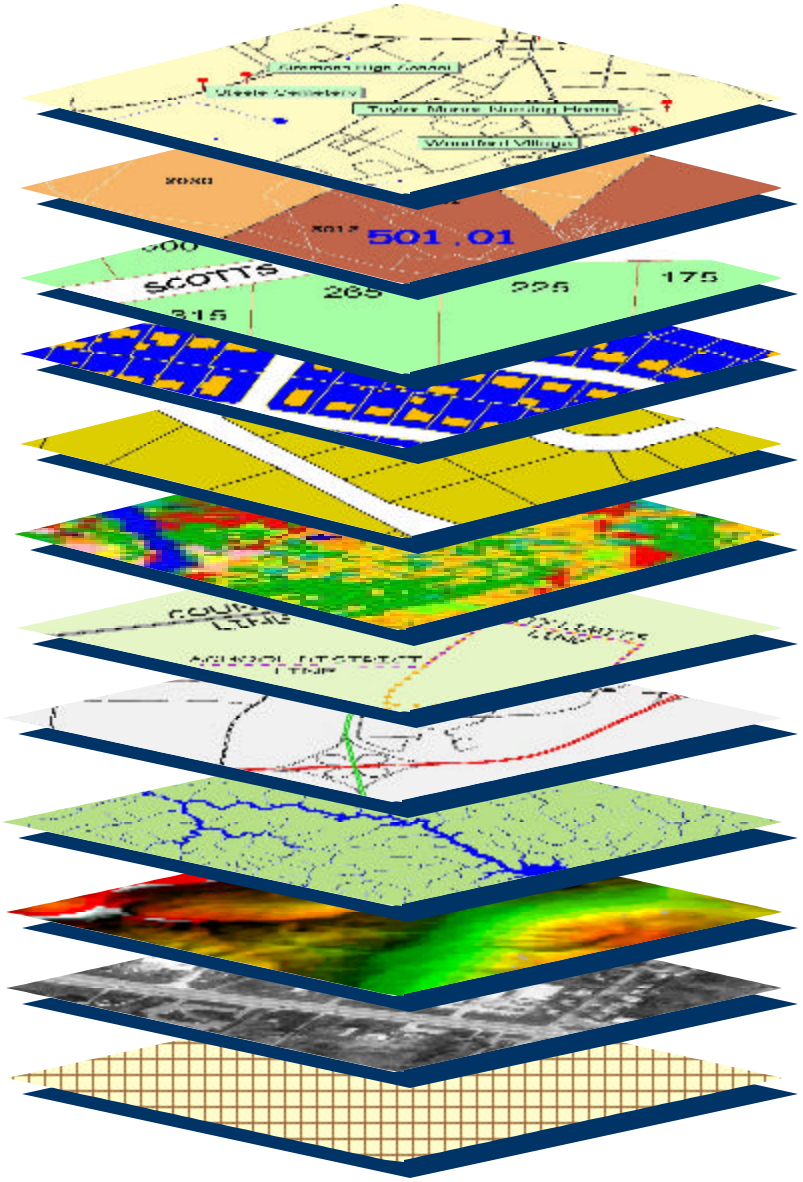
Office of Geographic Information—OGI (created in 1994—KRS 42.650)—***Governor's Office for Technology***

- *Coordinates* multiagency projects, *including statewide base map creation*
- Provides *consulting*, technical and policy *assistance*, *training*, and other *support* to state and local government
- Conducts, supports, and participates in *research* and *pilot projects*
- Serves as *liaison* to federal government
- Maintains geographic information *clearinghouse*
- Provides *staff support* to the Geographic Information Advisory Council (GIAC)

The Commonwealth Map

The Commonwealth Map will be a twelve layer statewide digital basemap available free via the Internet for interactive mapping and geographic data querying and downloading. As a collaborative effort of local, state, and federal partners, this initiative is designed to facilitate public, non-profit, and private sector geographic information systems (GIS) development, utilization, innovation, and data sharing. It will be Kentucky's contribution to ***The National Map***.

"THE COMMONWEALTH MAP"



Geographic Names*

Census

Addresses

Structures*

Parcels

Land Cover*

Boundaries*

Transportation*

Hydrography*

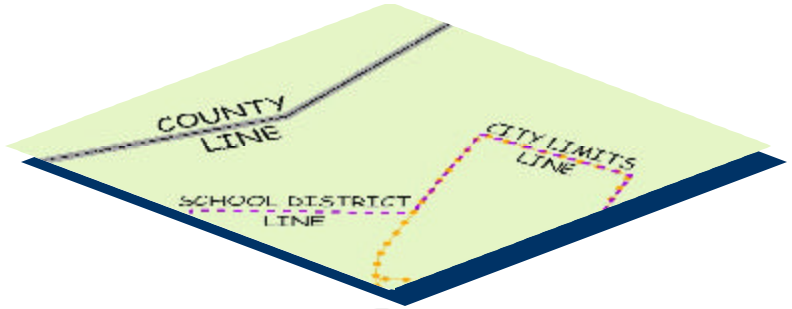
Elevation*

Orthoimagery*

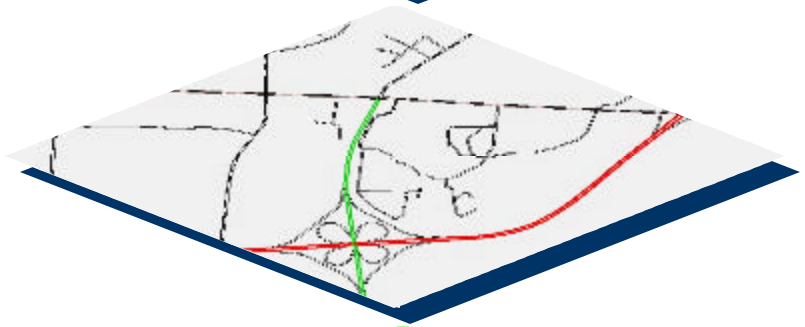
Geodesy

*The National Map Layer

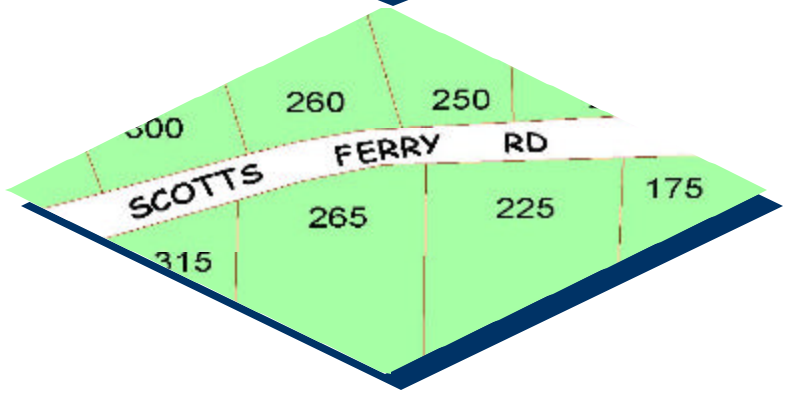
Basic (essential) Layers for 911 Response



Boundaries



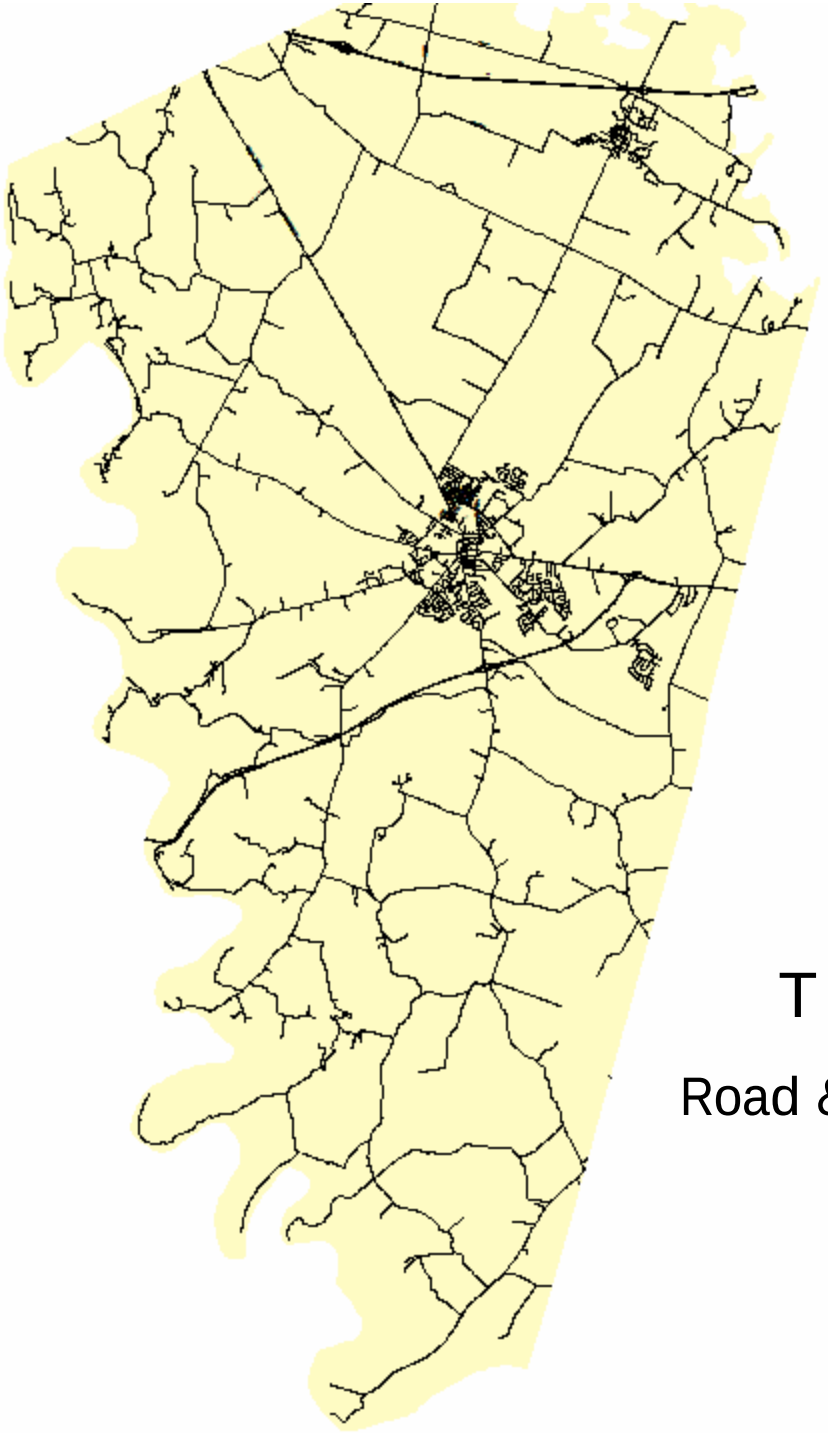
Transportation



Addresses

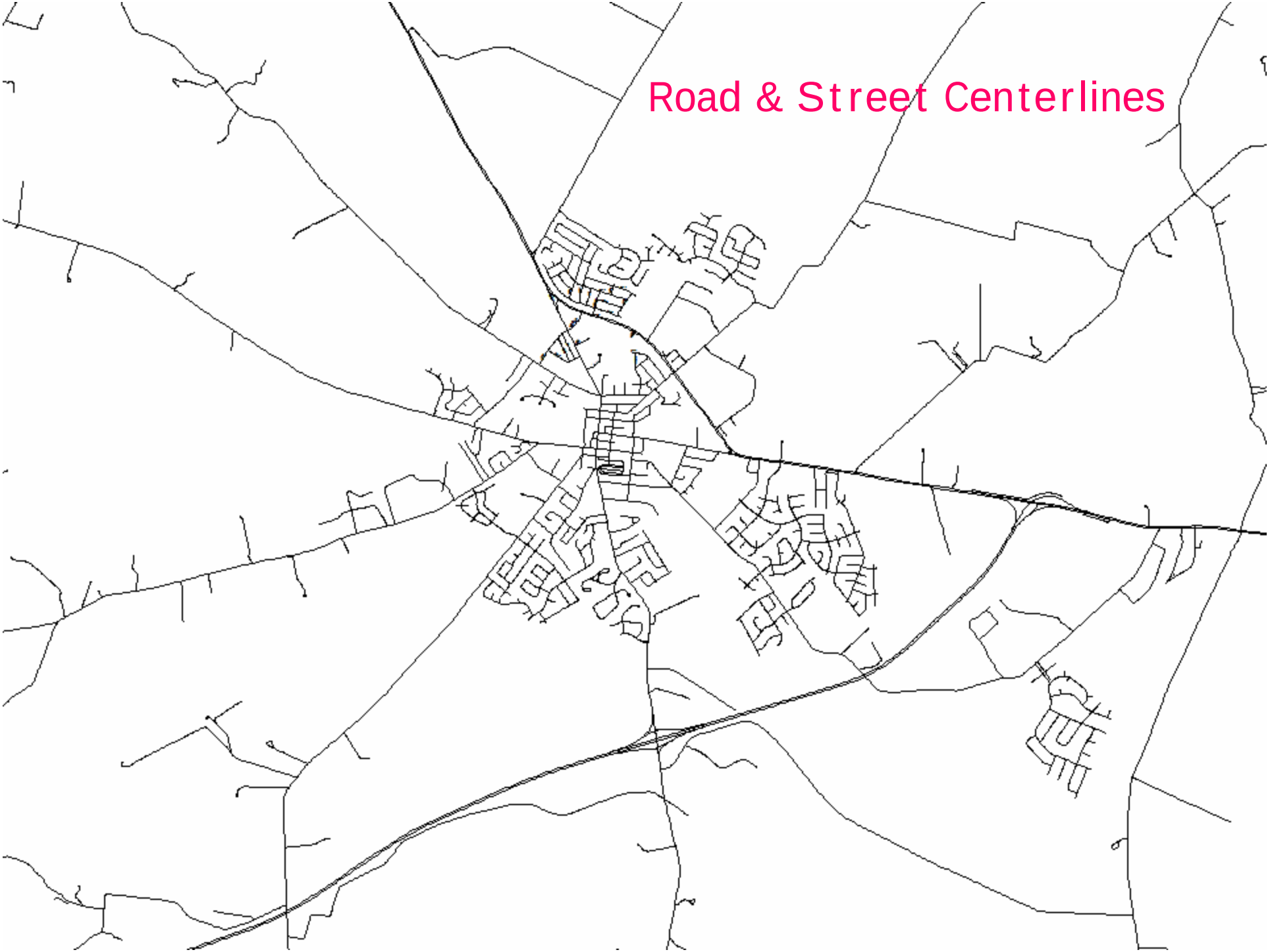
Boundaries

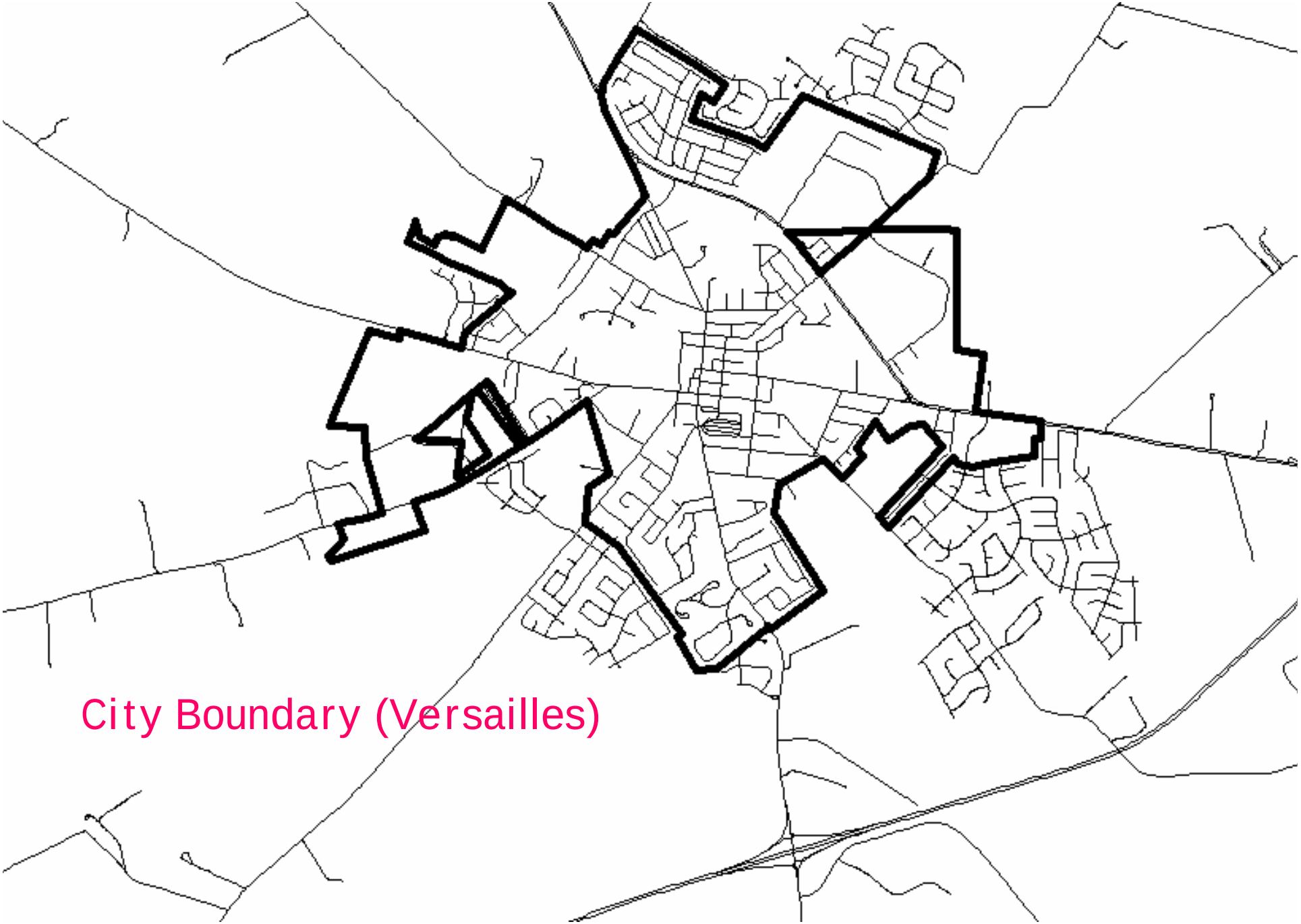
Woodford County



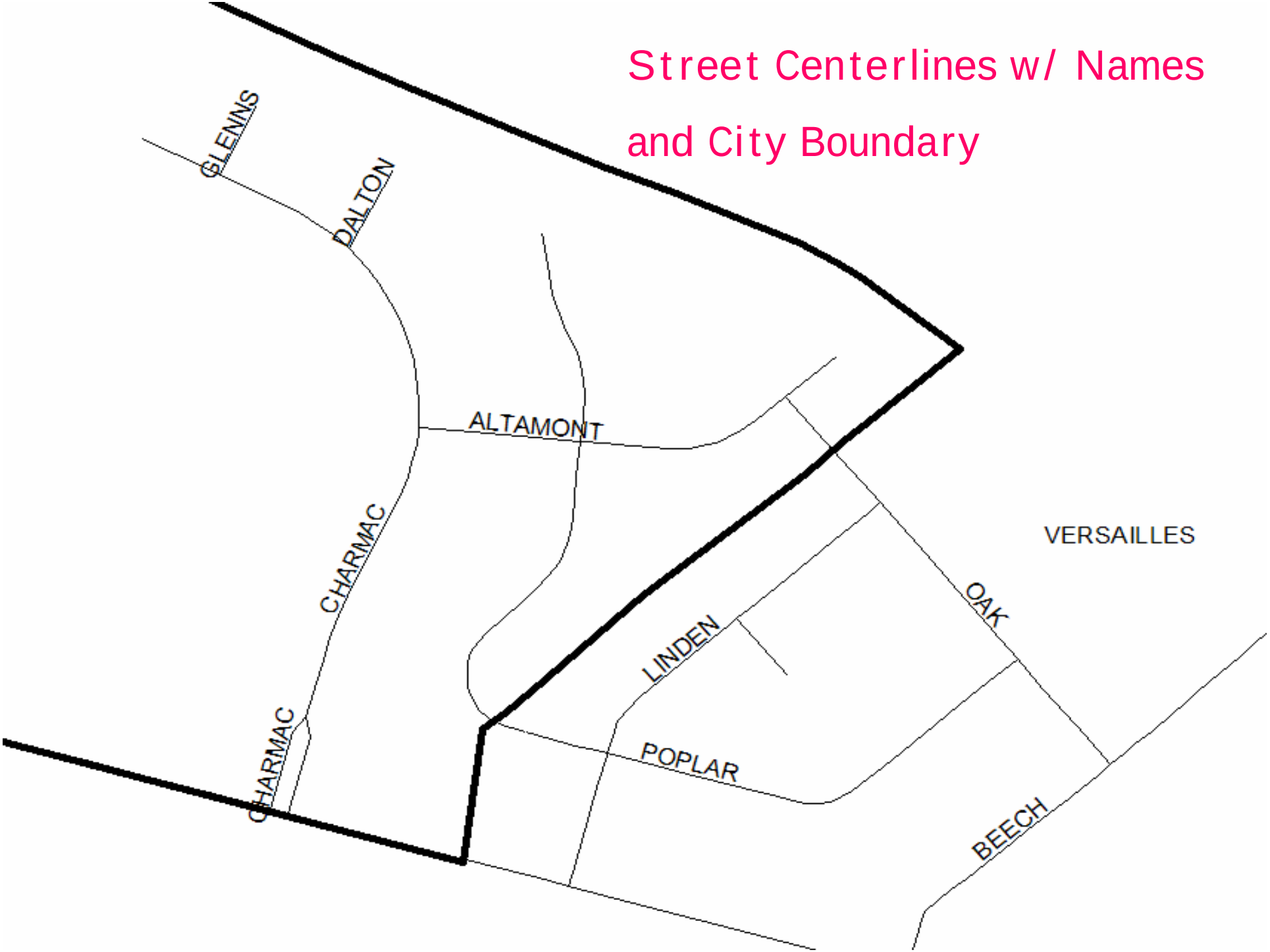
Transportation

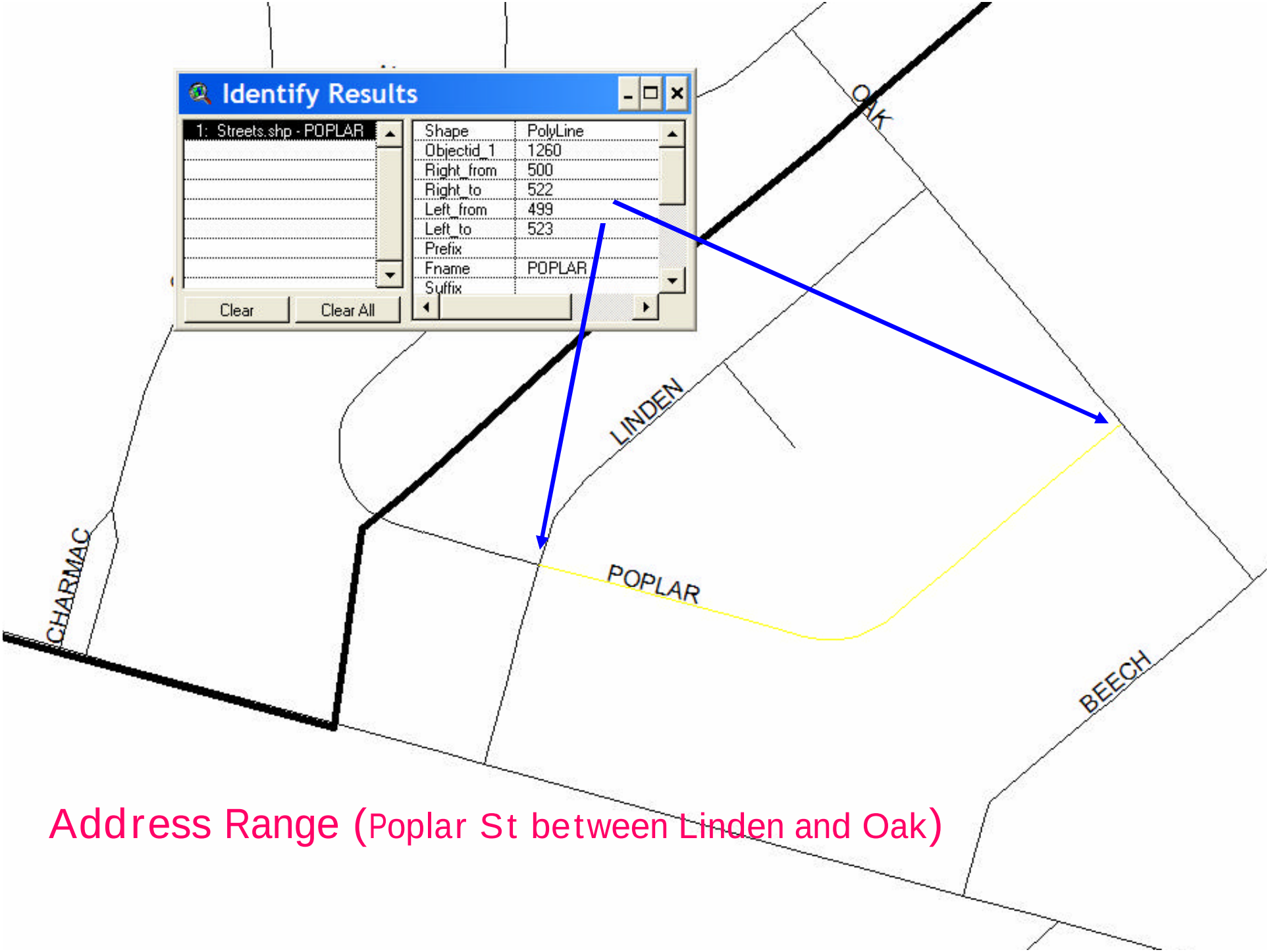
Road & Street Centerlines


Road & Street Centerlines

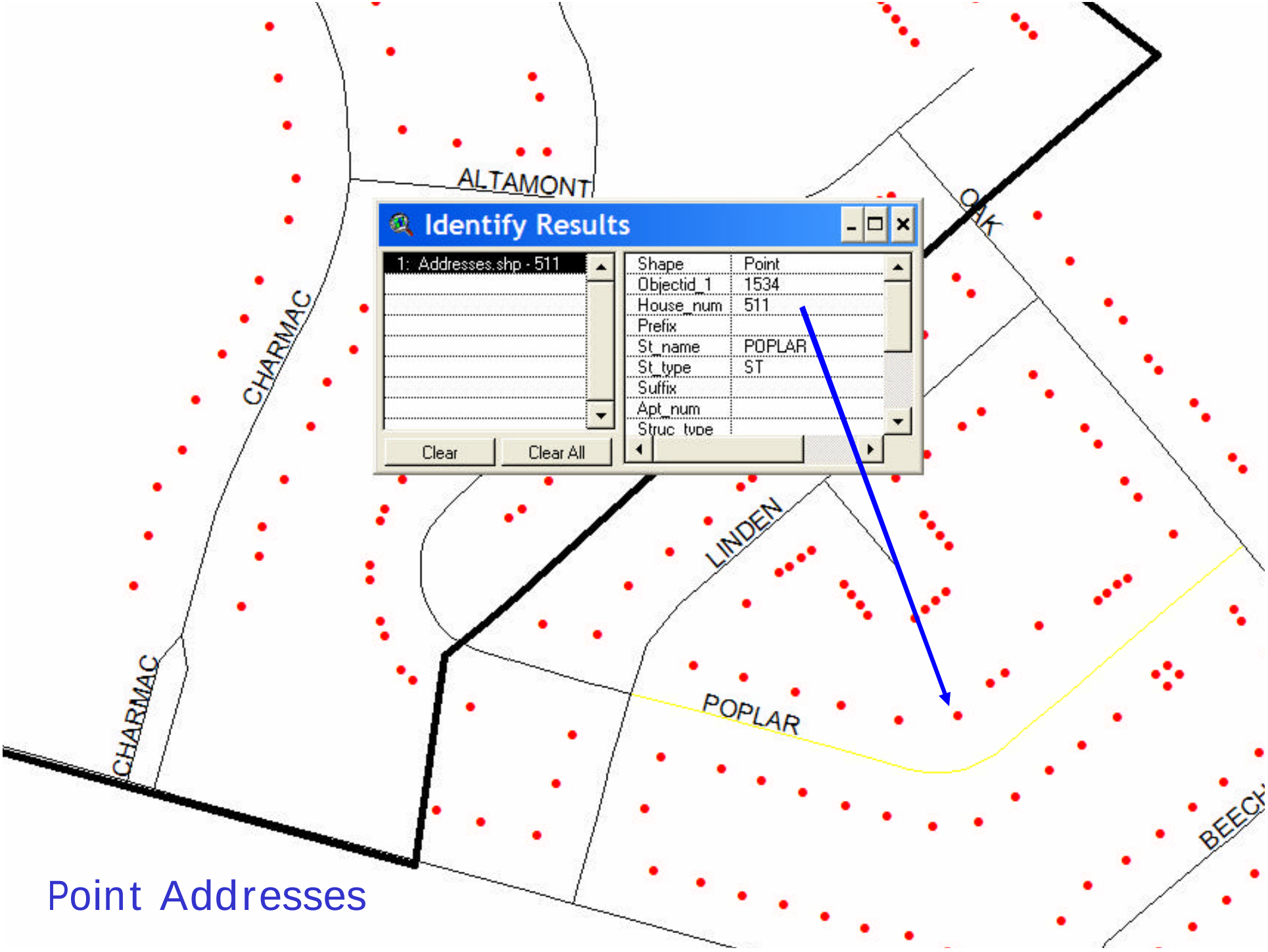

City Boundary (Versailles)

Street Centerlines w/ Names and City Boundary





Address Range (Poplar St between Linden and Oak)

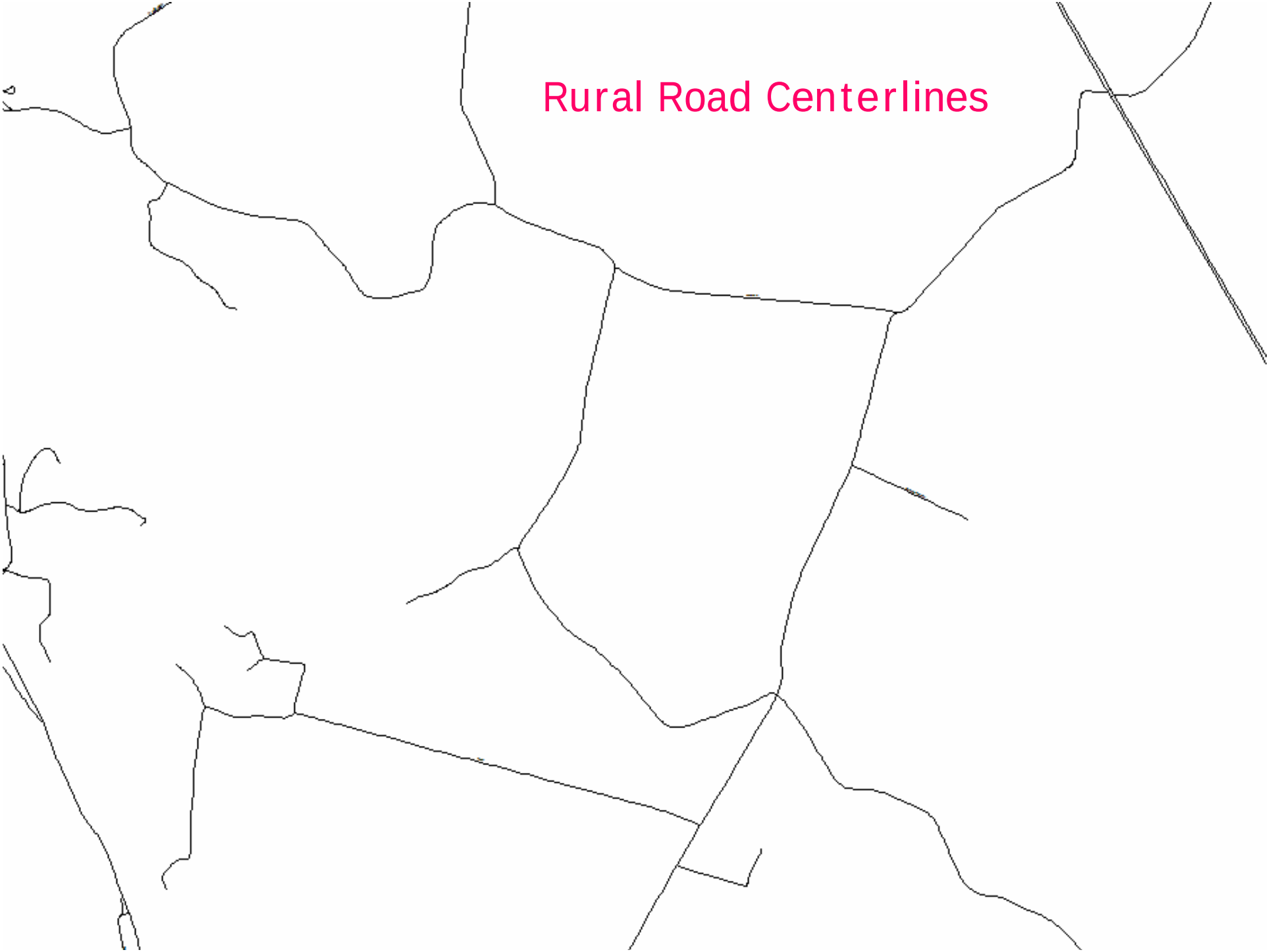


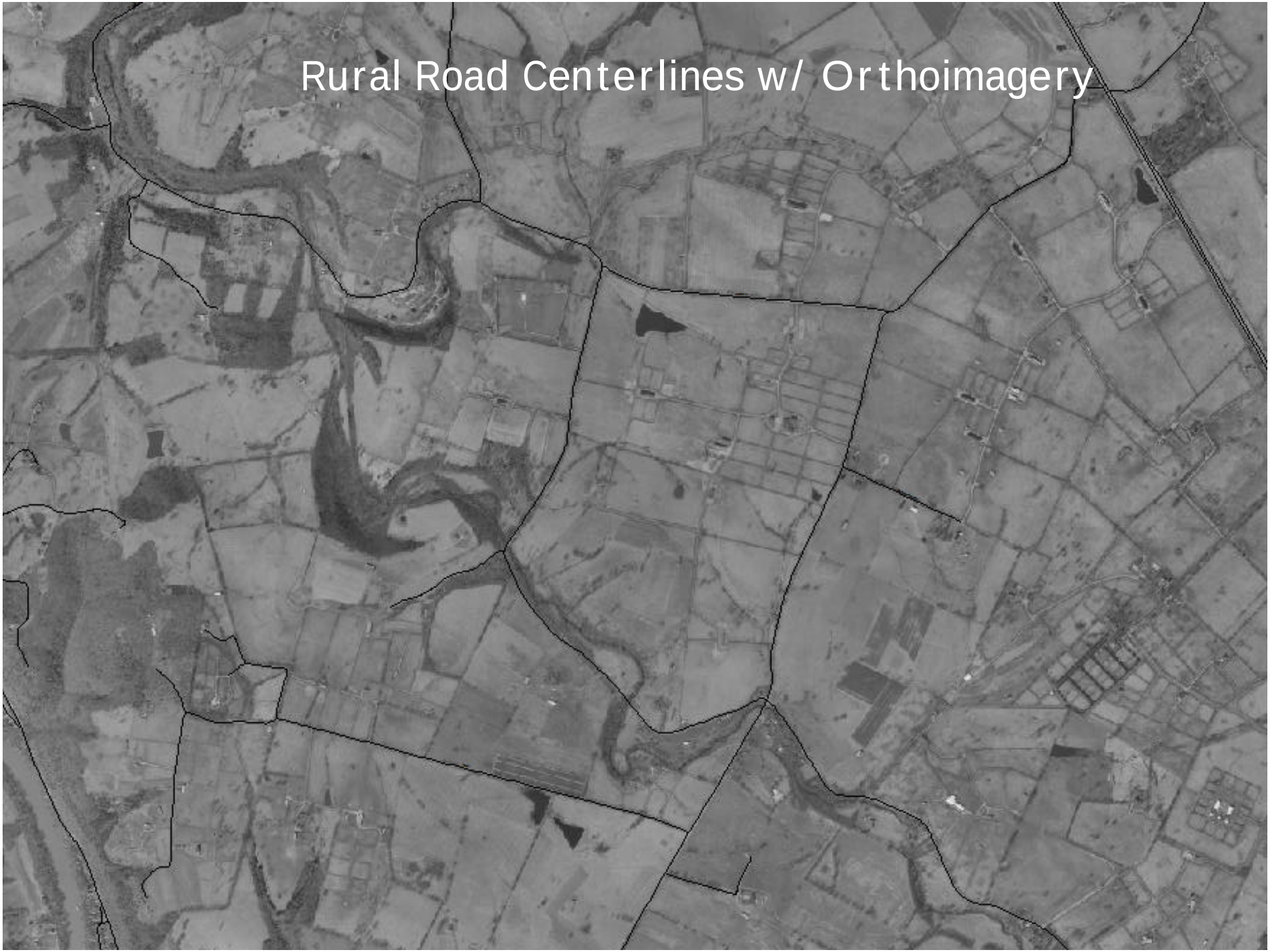
Point Addresses

Informational Layers for 911 Response

Orthoimagery

Provides visual assistance (bird's eye view)

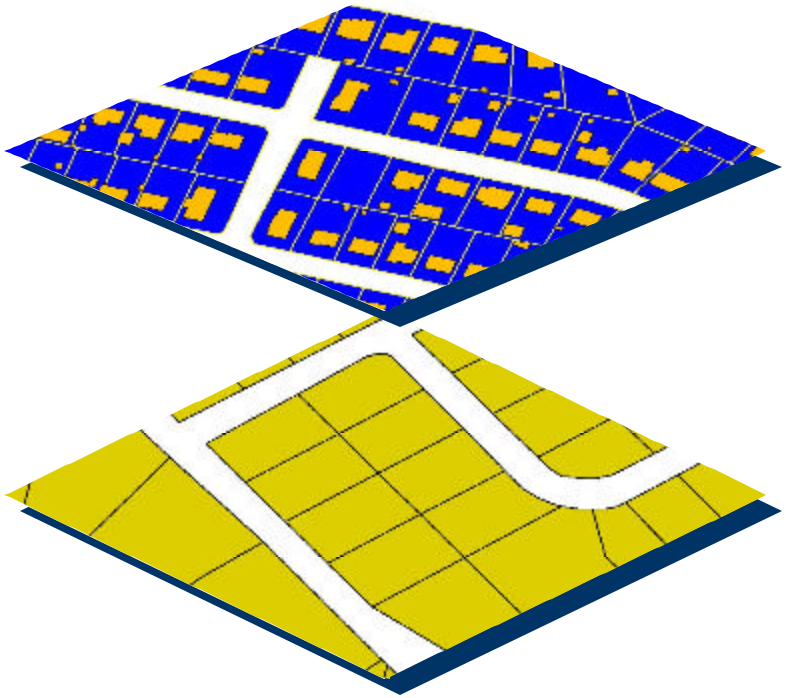

Rural Road Centerlines


Rural Road Centerlines w/ Orthoimagery


Urban Street Centerlines
NORTH
RD ALLEN
SABLE
GREEN
HENTON
TANNER
AMSDEN
COURT
LOCUST
GRANDUCCI
TILFORD
TILFORD
BOWMAR
MAPLE
MAIN
MORGAN


Urban Street Centerlines w/ Orthoimagery
NORTH
D'ALLEN
SABLE
GREEN
HENTON
TANNER
AMSDEN
COURT
LOCUST
TILFORD
TILFORD
GRANDUCCI
MAIN
BOWMAR
MAPLE
MORGAN

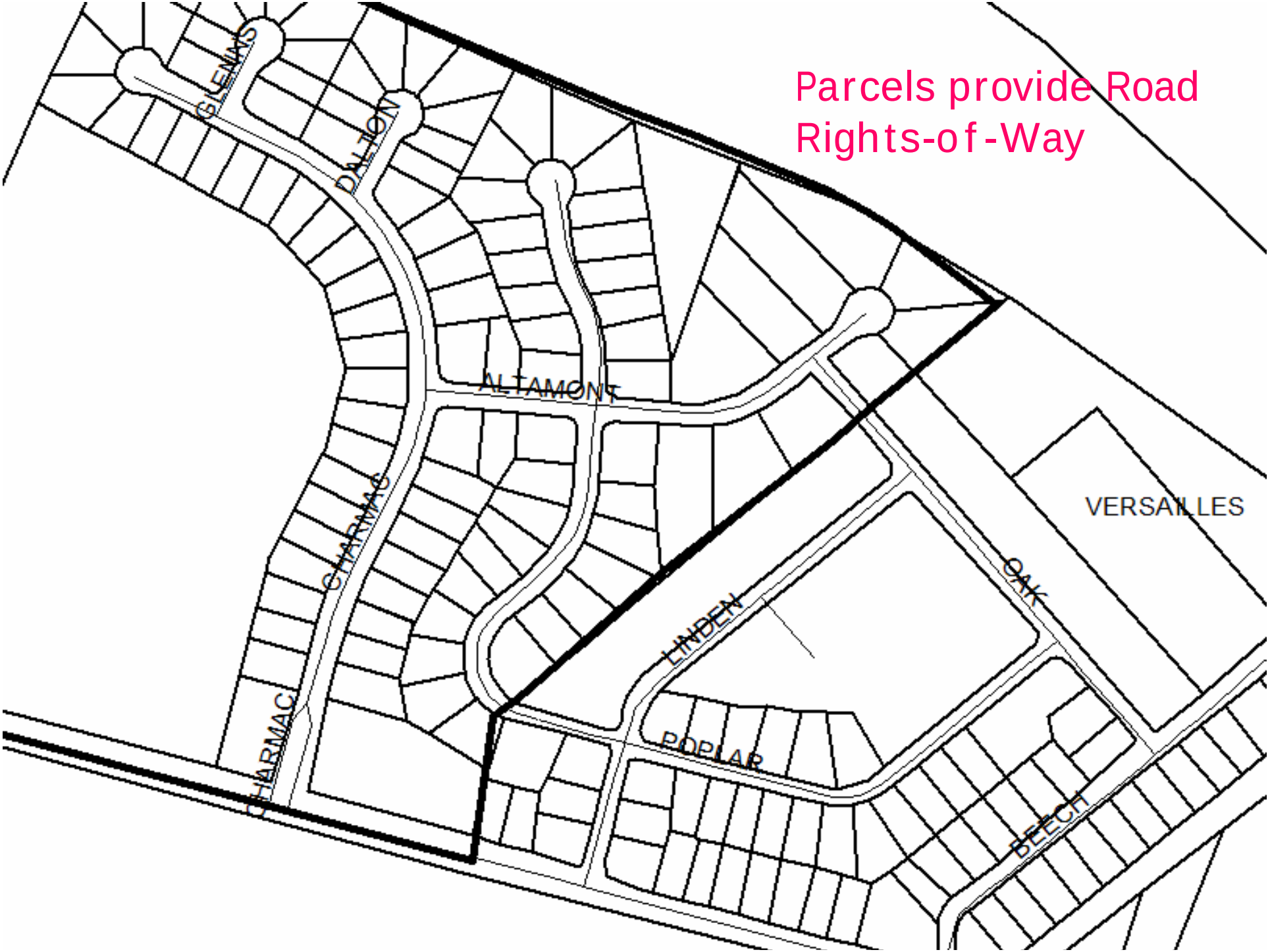
Informational Layers: Cultural Features



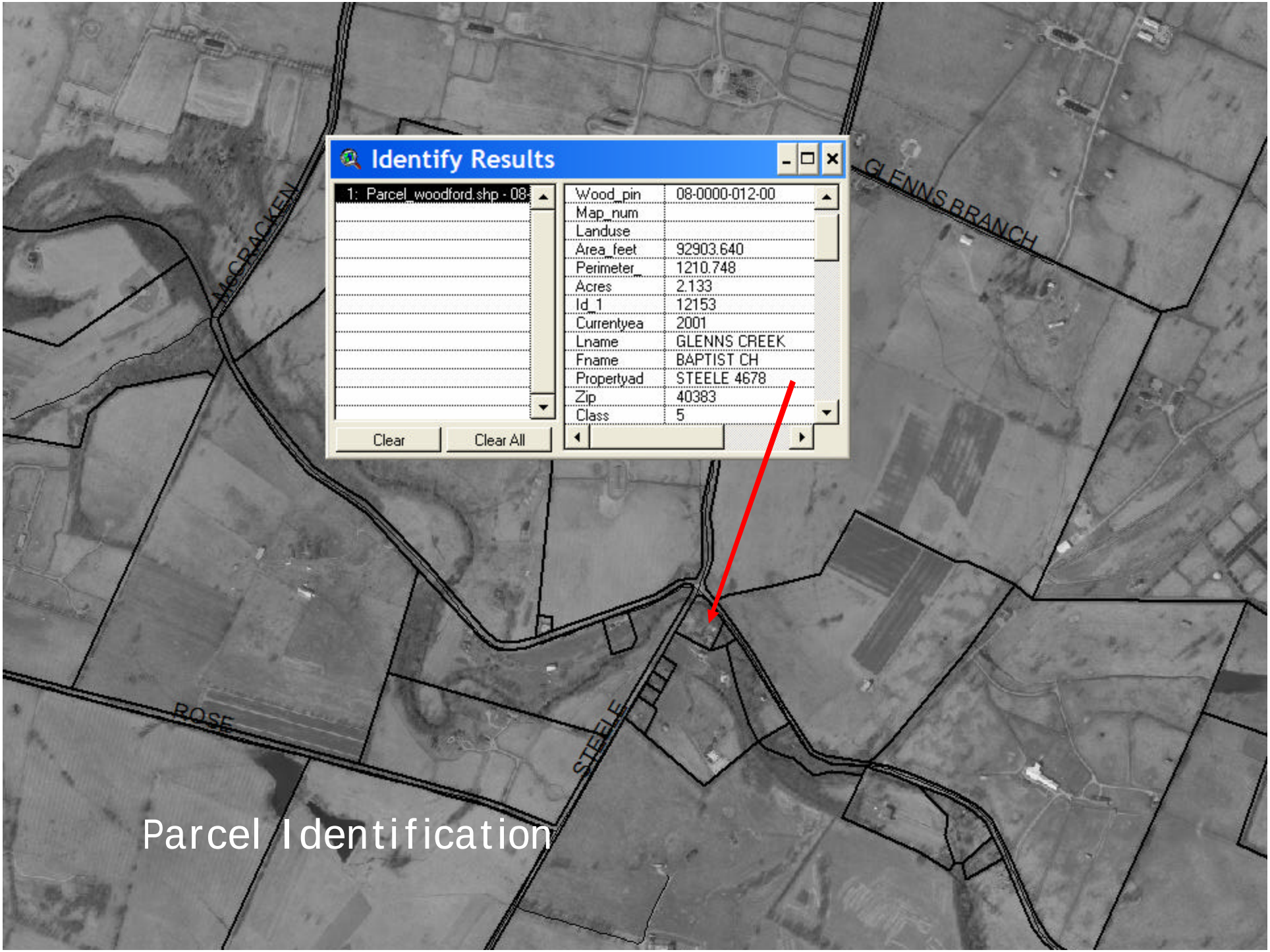
Structures

Parcels

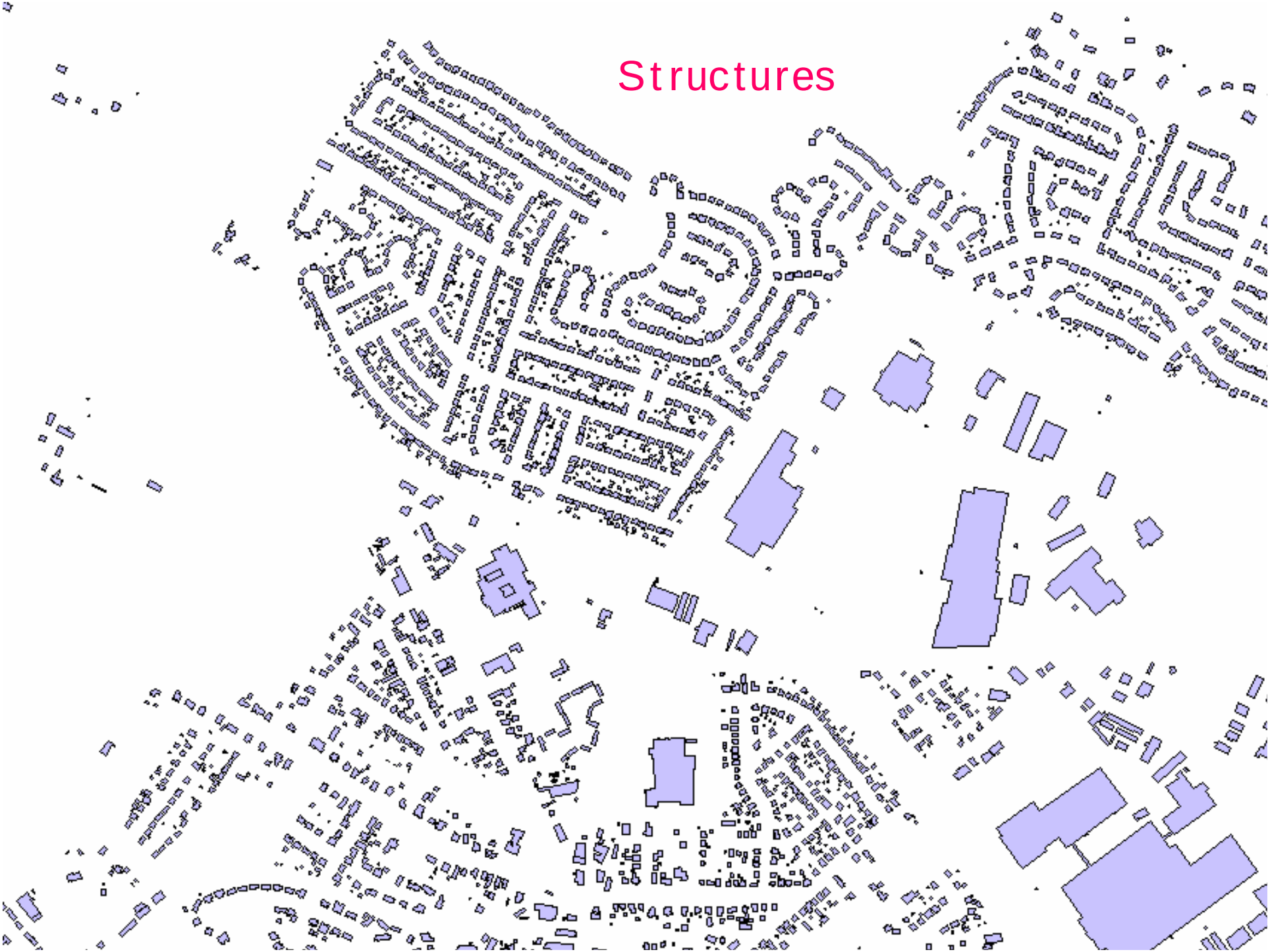
Helps in location determination and provides attribute information (such as property owner or building usage)

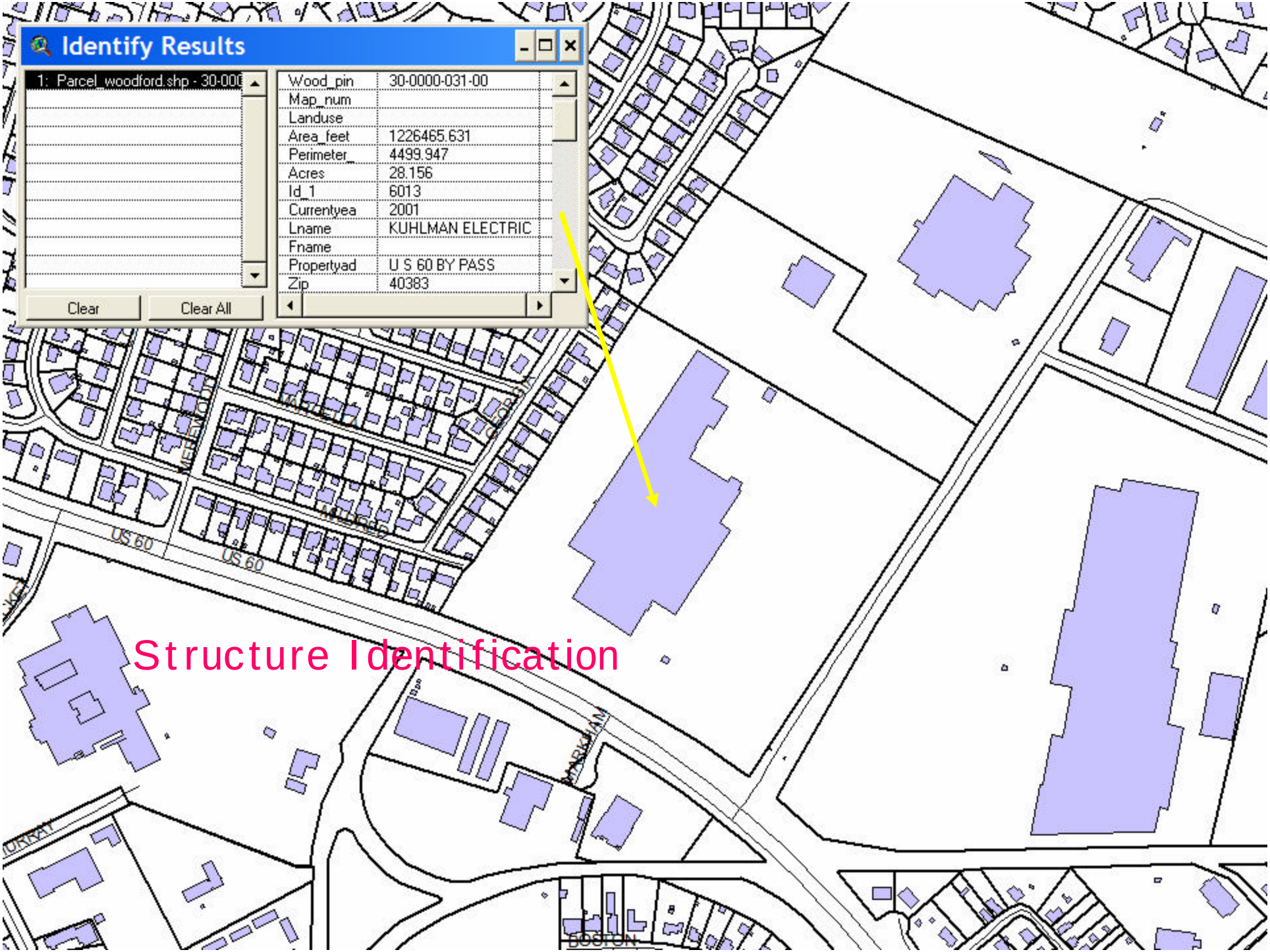

Parcels provide Road Rights-of-Way
GLENNIS
DALTON
ALTAMONT
CHARMAC
CHARMAC
VERSAILLES
OAK
LINDEN
POPLAR
BEECH


Parcels w/Orthoimagery
GLENN
DALTON
ALTAMONT
CHARMAC
CHARMAC
LINDEN
POPLAR
OAK
BEECH
VERSAILLES

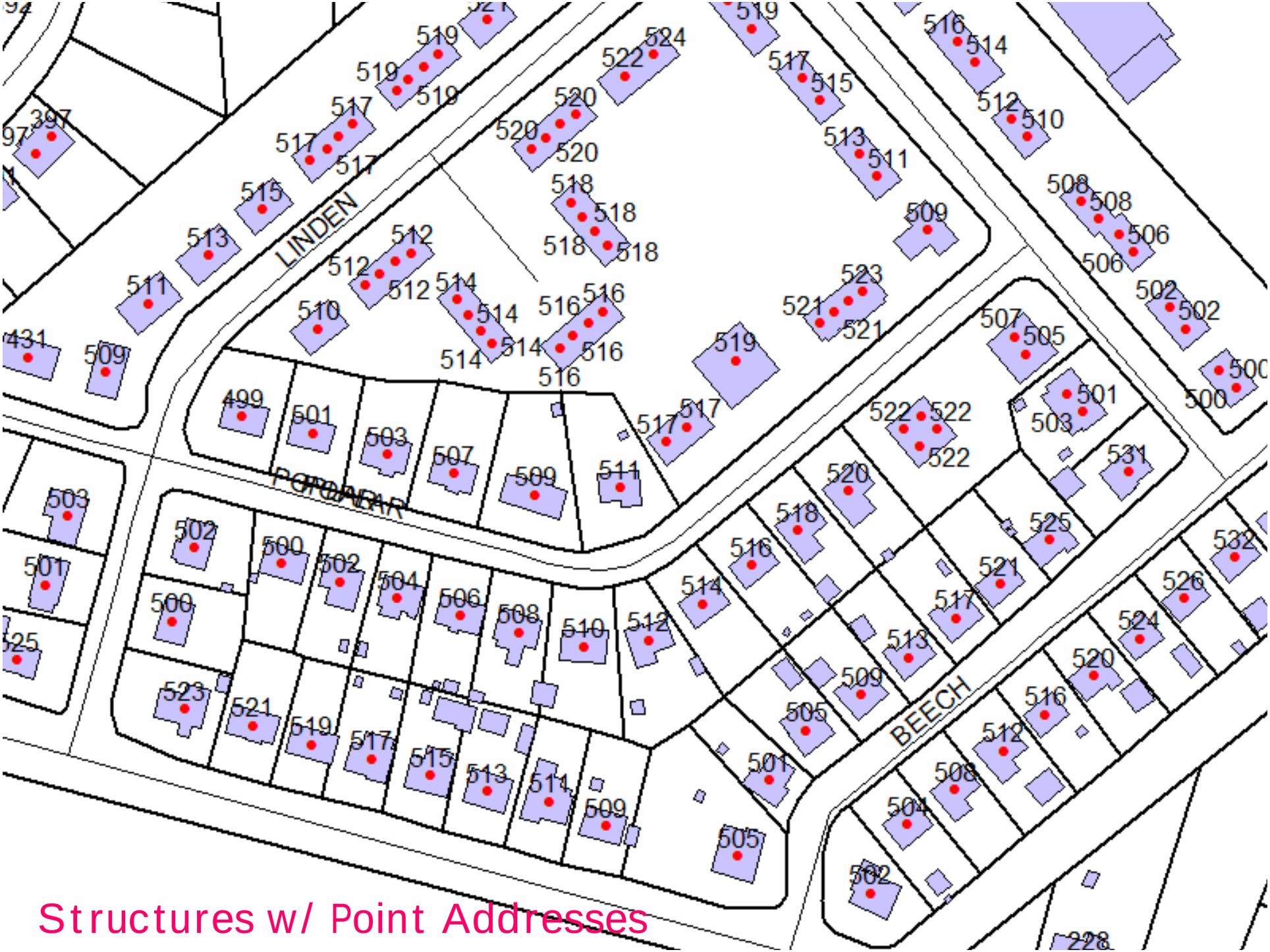


Parcel Identification


Structures

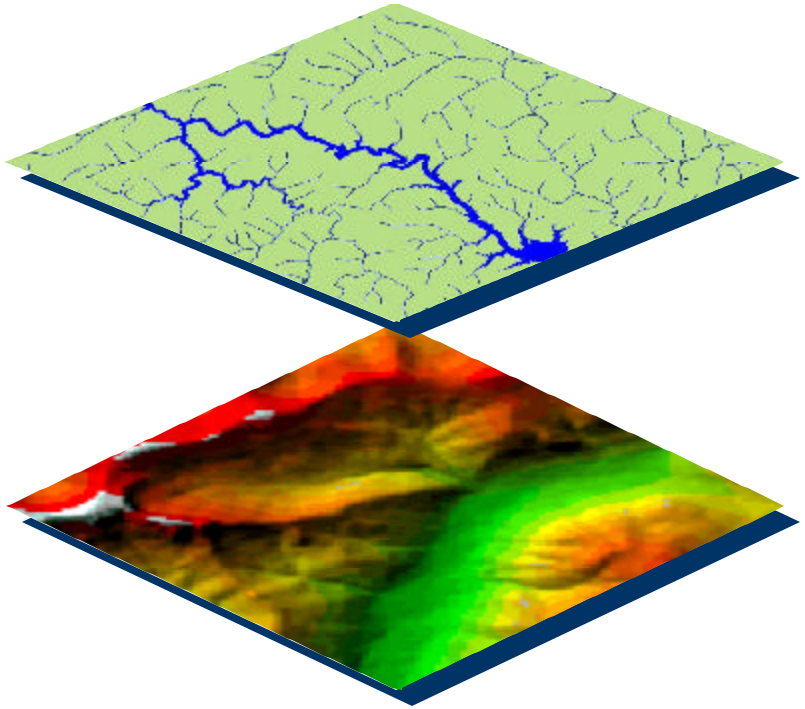

Identify Results
1: Parcel_woodford.shp - 30-000
Wood_pin 30-0000-031-00
Map_num
Landuse
Area_feet 1226465.631
Perimeter_ 4499.947
Acres 28.156
Id_1 6013
Currentyea 2001
Lname KUHLMAN ELECTRIC
Fname
Propertyad U S 60 BY PASS
Zip 40383
Clear
Clear All
US 60
US 60
Structure Identification


Structures w/ Imagery
DALTON
ALTAMONT
CHARMAC
LINDEN
OAK
VERSAILLES
POPLAR
BEECH



Structures w/ Point Addresses

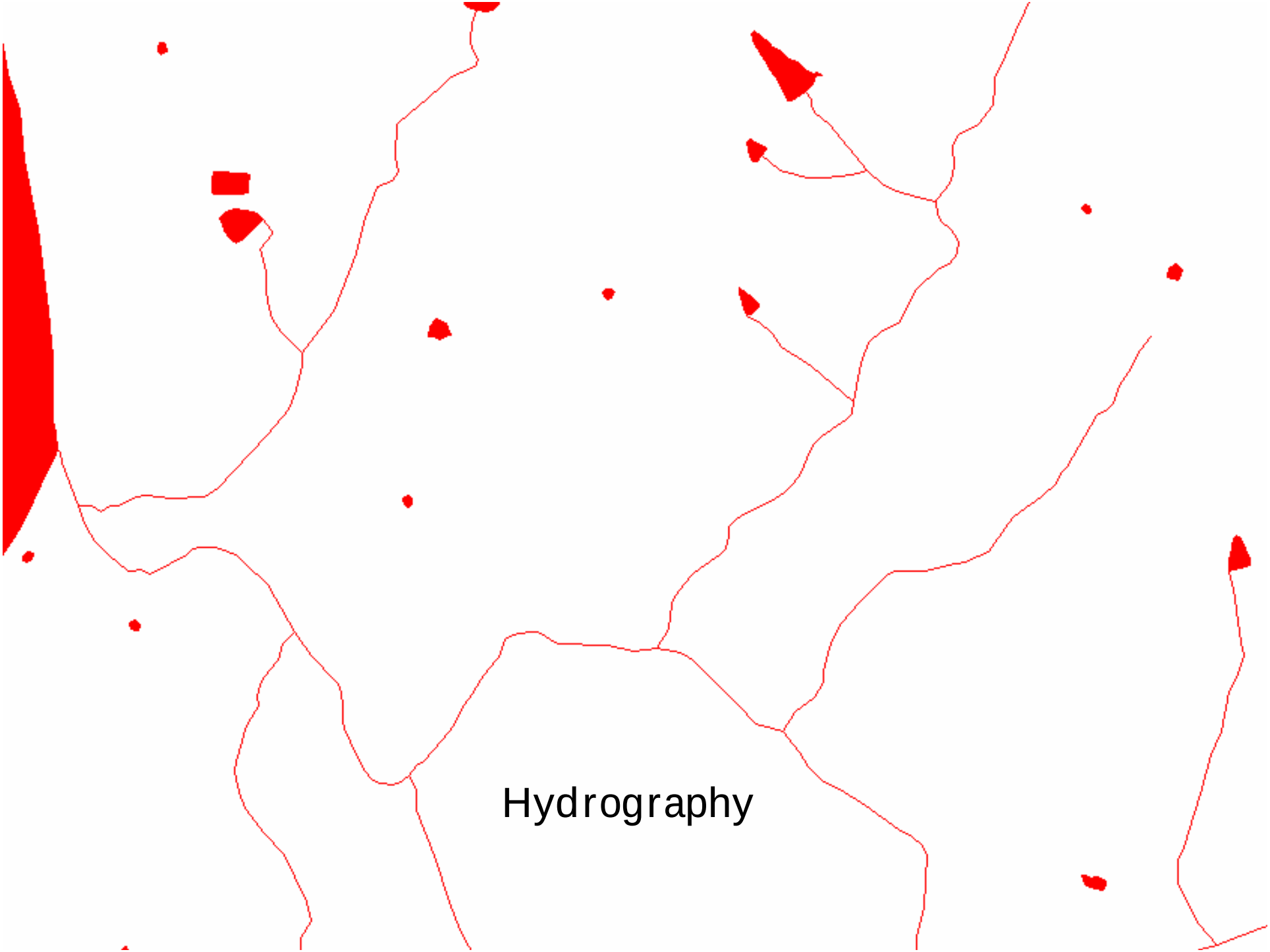
Informational Layers: Physical Features

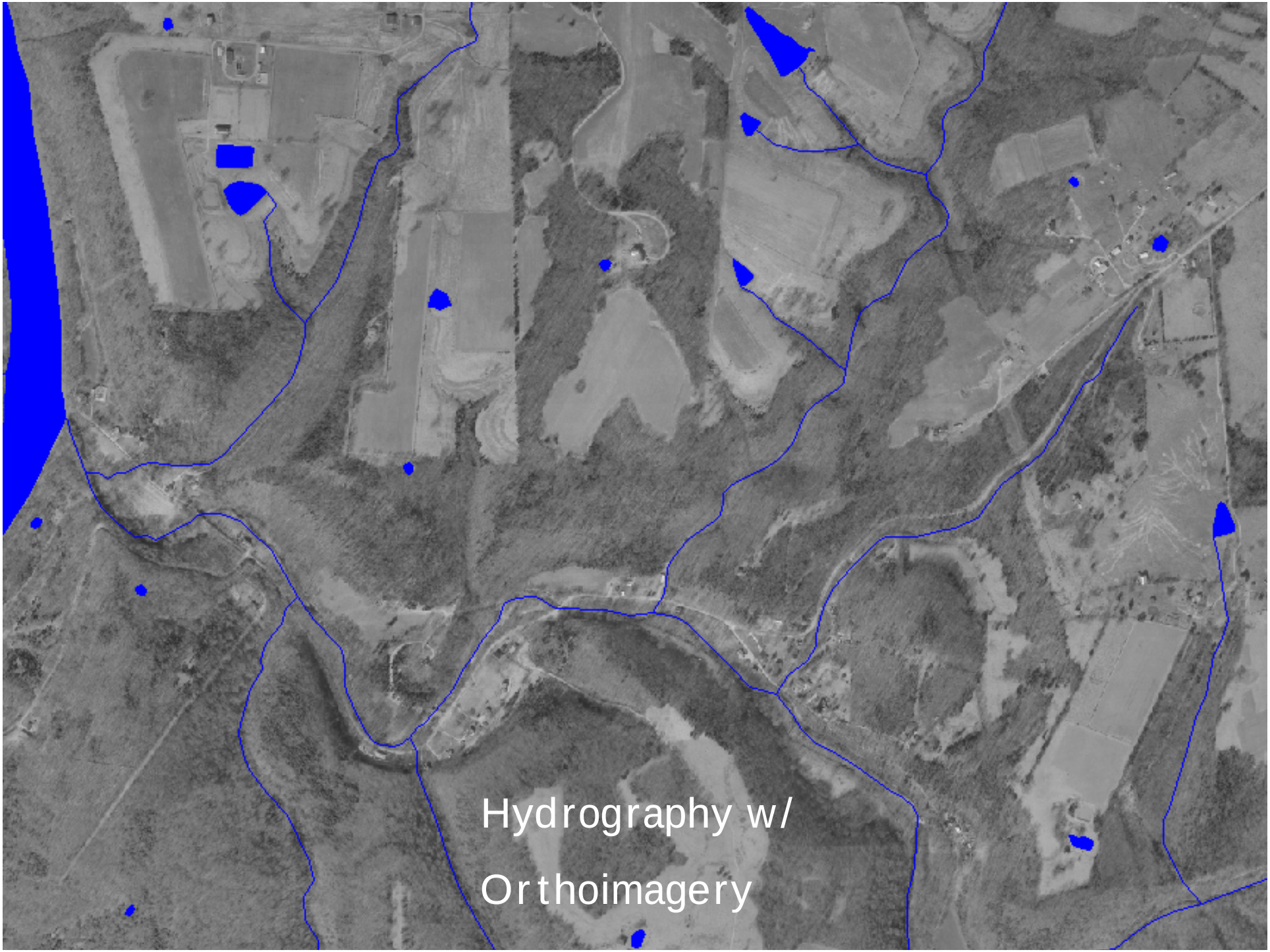


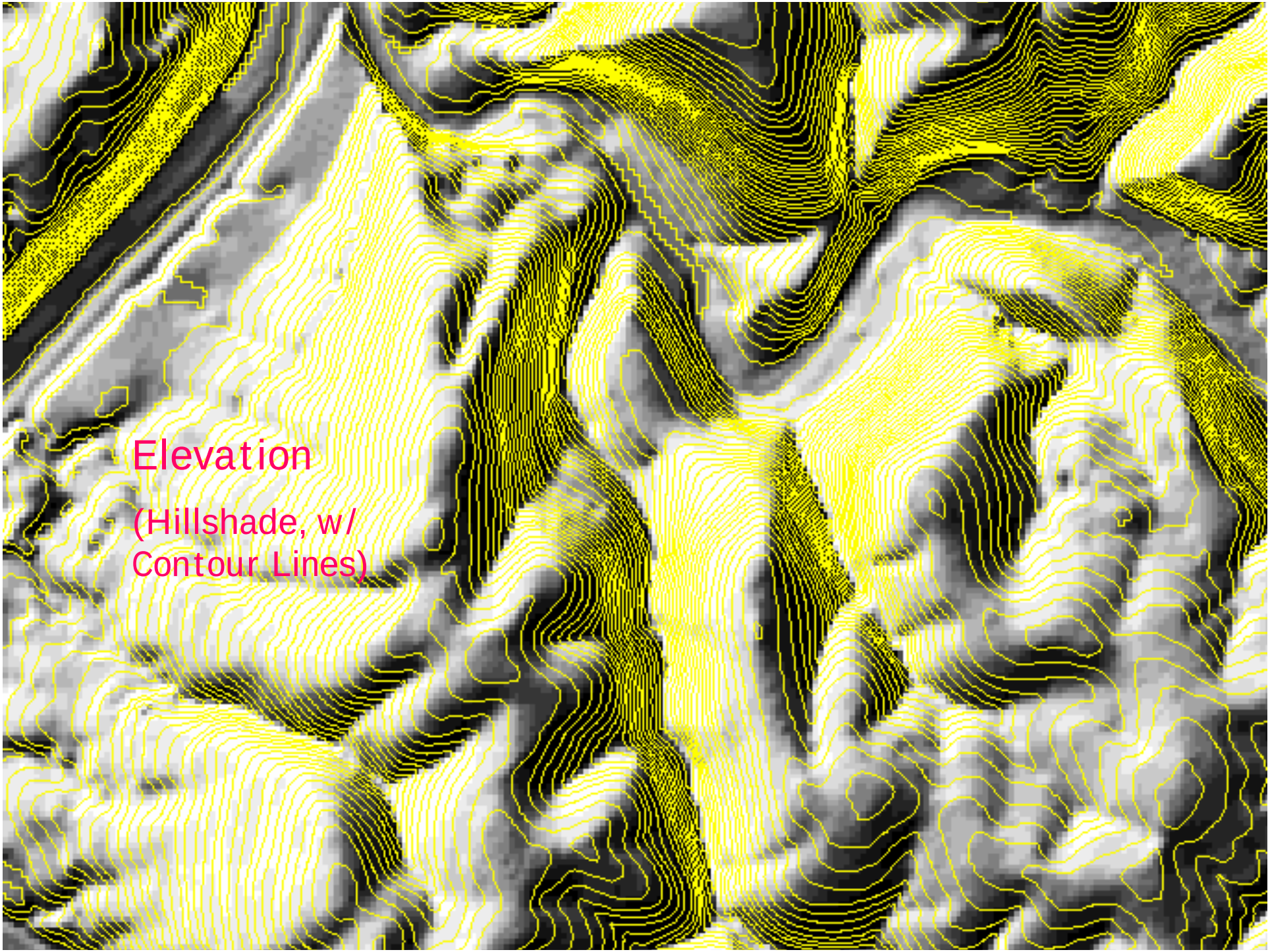
Hydrography

Elevation

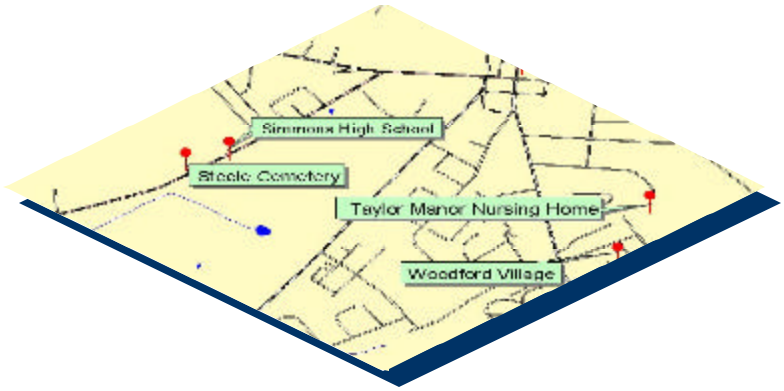
Expands “picture” of the physical setting in conjunction with orthoimagery—and helps with location “clues”


Hydrography


Hydrography w/
Orthoimagery


Elevation
(Hillshade, w/
Contour Lines)

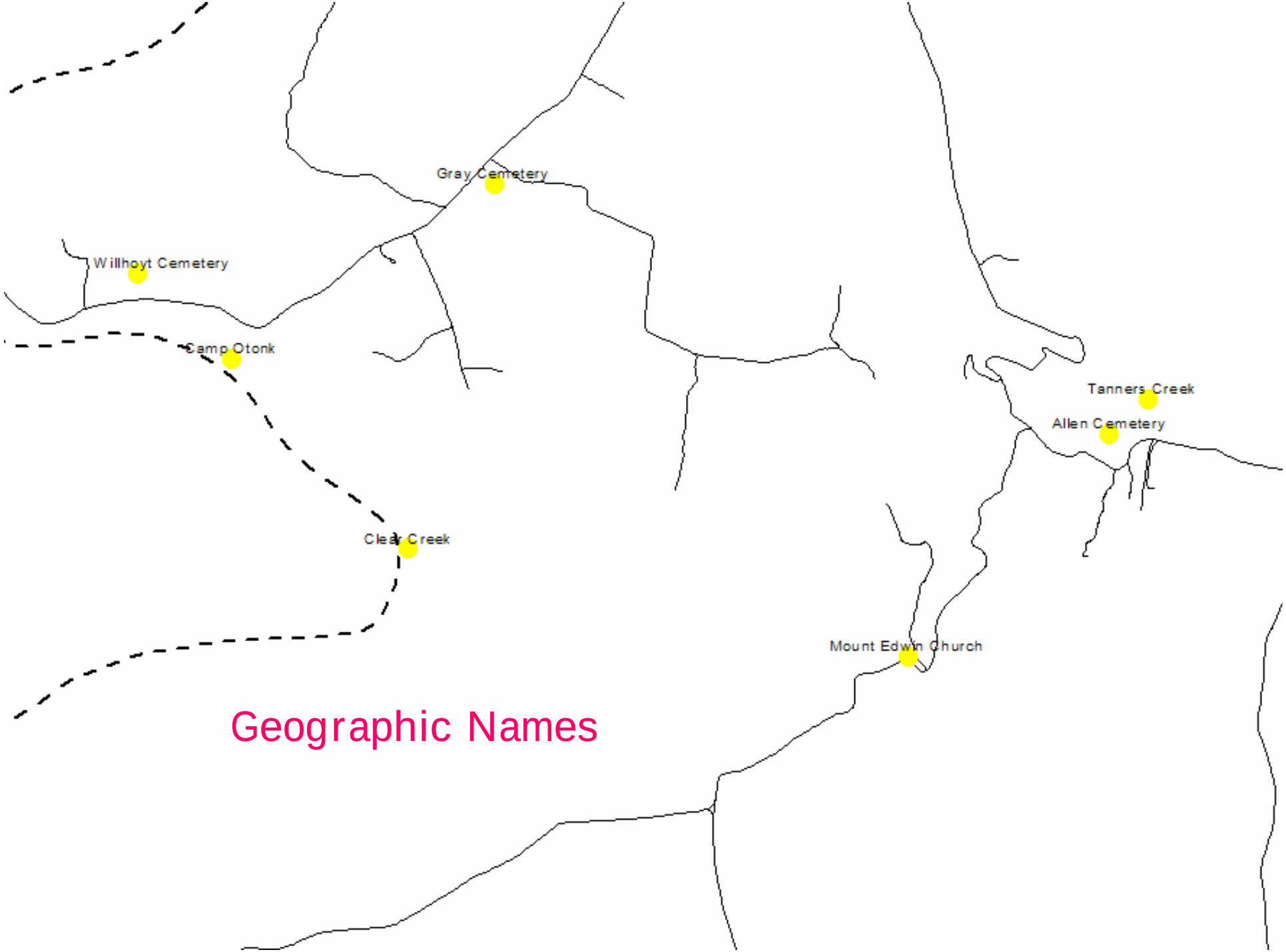
Informational Layer: Feature Identification

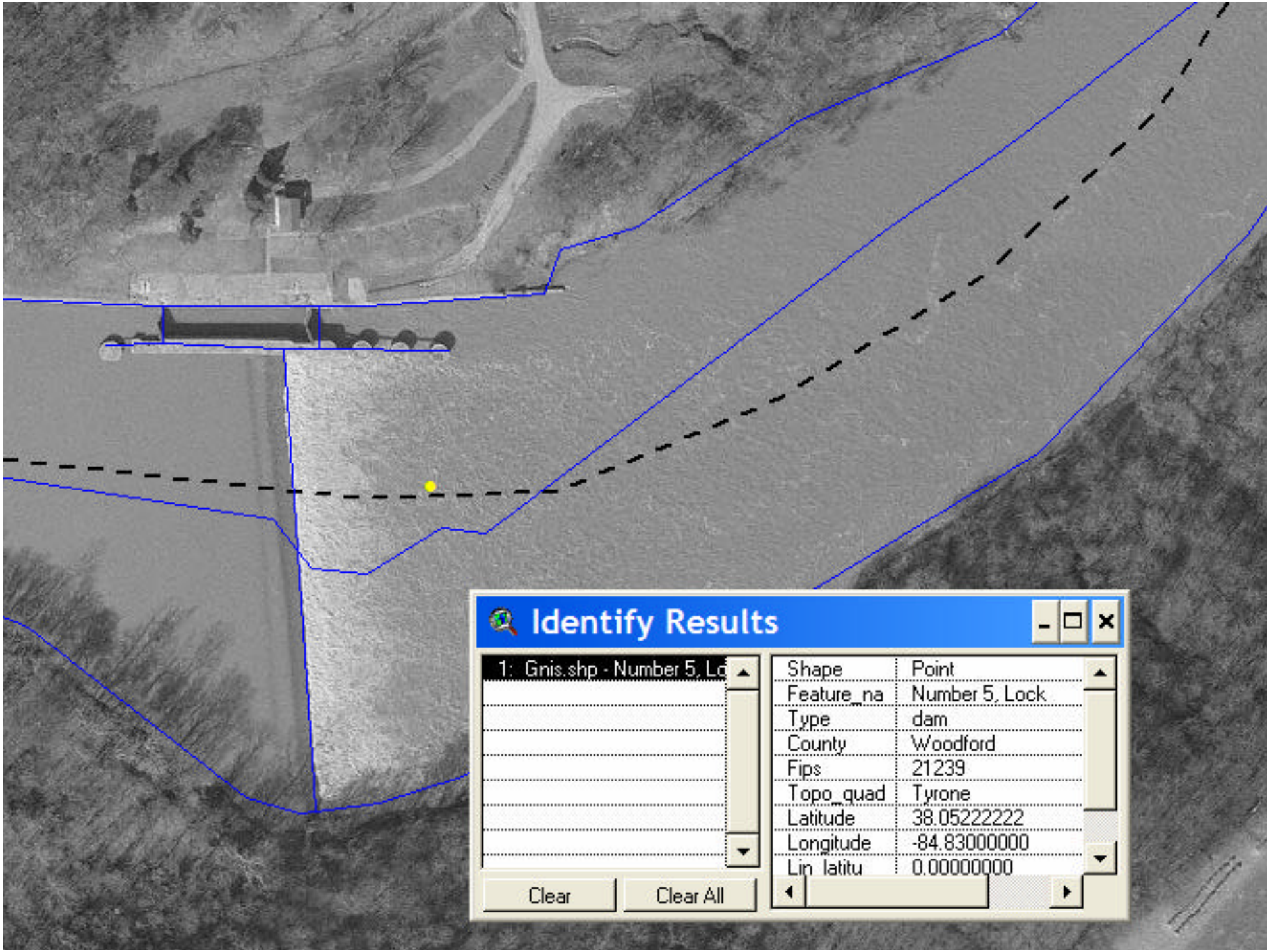


Geographic Names

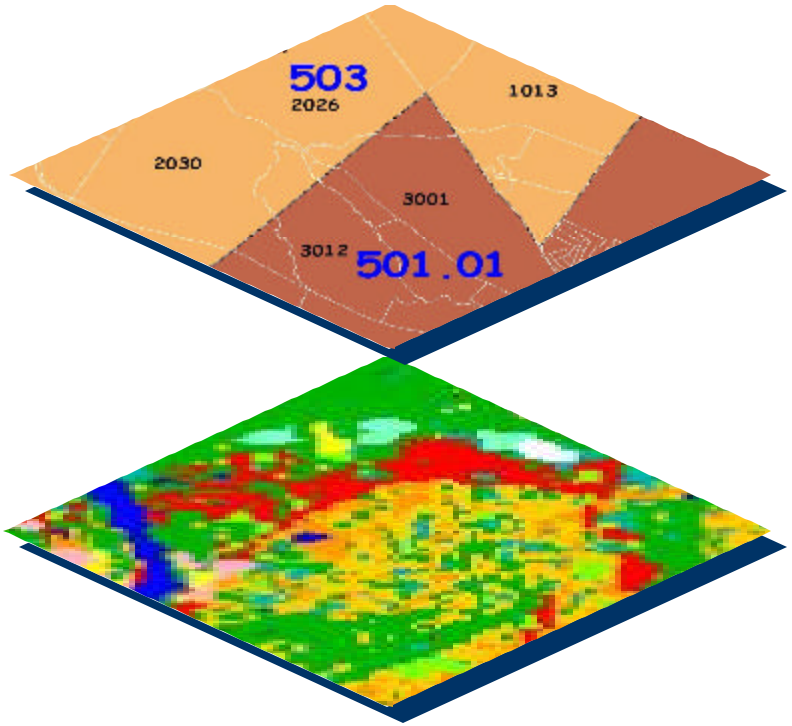
Geographic Names Information System covers both physical features and cultural features (with the exception of roads and streets)

Kentucky has GNIS I (names from USGS topographic maps)—needs upgrade to GNIS II (other names, including historical names)


Gray Cemetery
Willhoyt Cemetery
Camp Otonk
Clear Creek
Tanners Creek
Allen Cemetery
Mount Edwin Church
Geographic Names


Identify Results
1: Gnis.shp - Number 5, Lo
Shape
Point
Feature_na
Number 5, Lock
Type
dam
County
Woodford
Fips
21239
Topo_quad
Tyrone
Latitude
38.05222222
Longitude
-84.83000000
Lin_latitu
0.00000000
Clear
Clear All

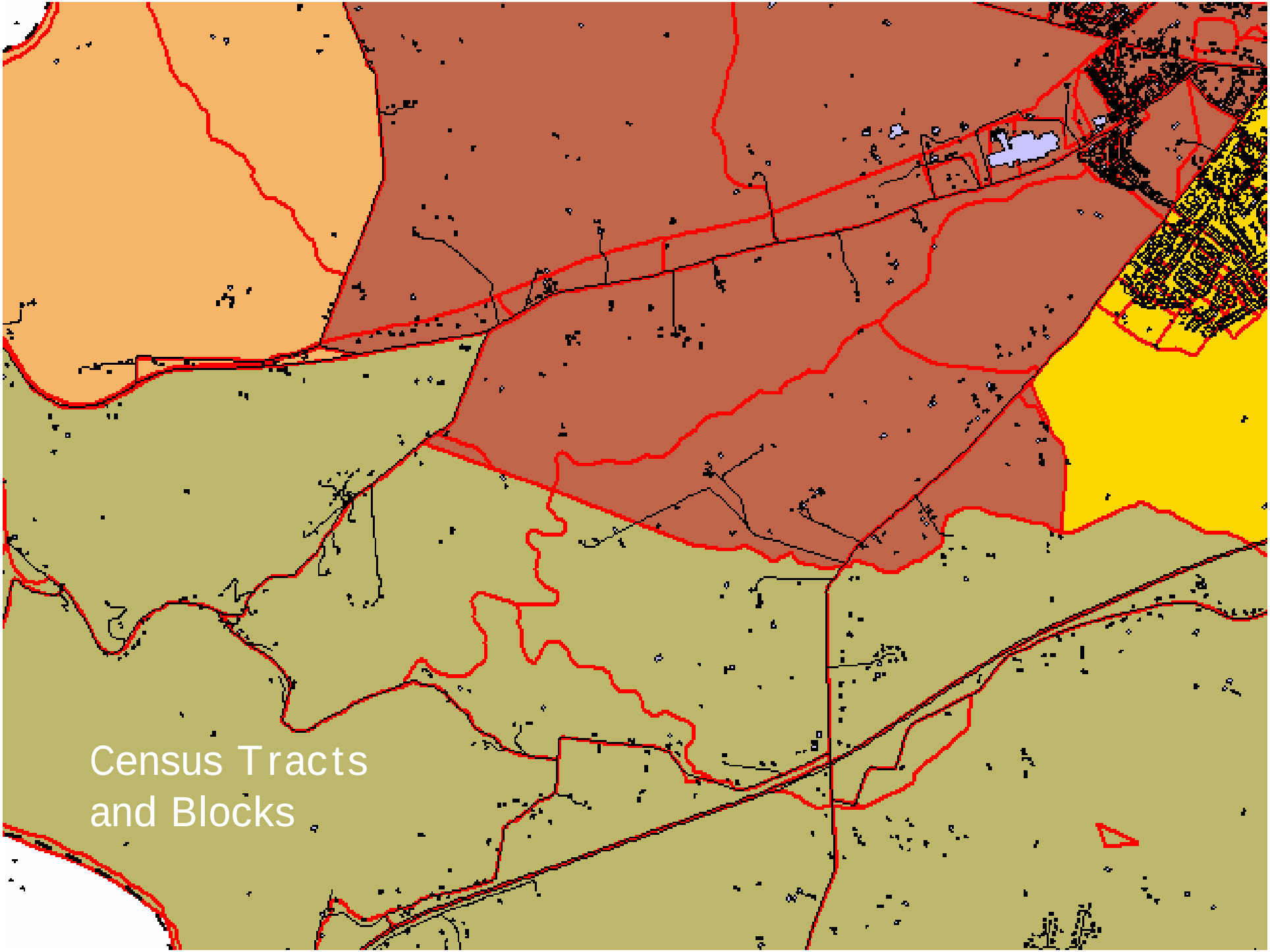
Research and Administration Layers

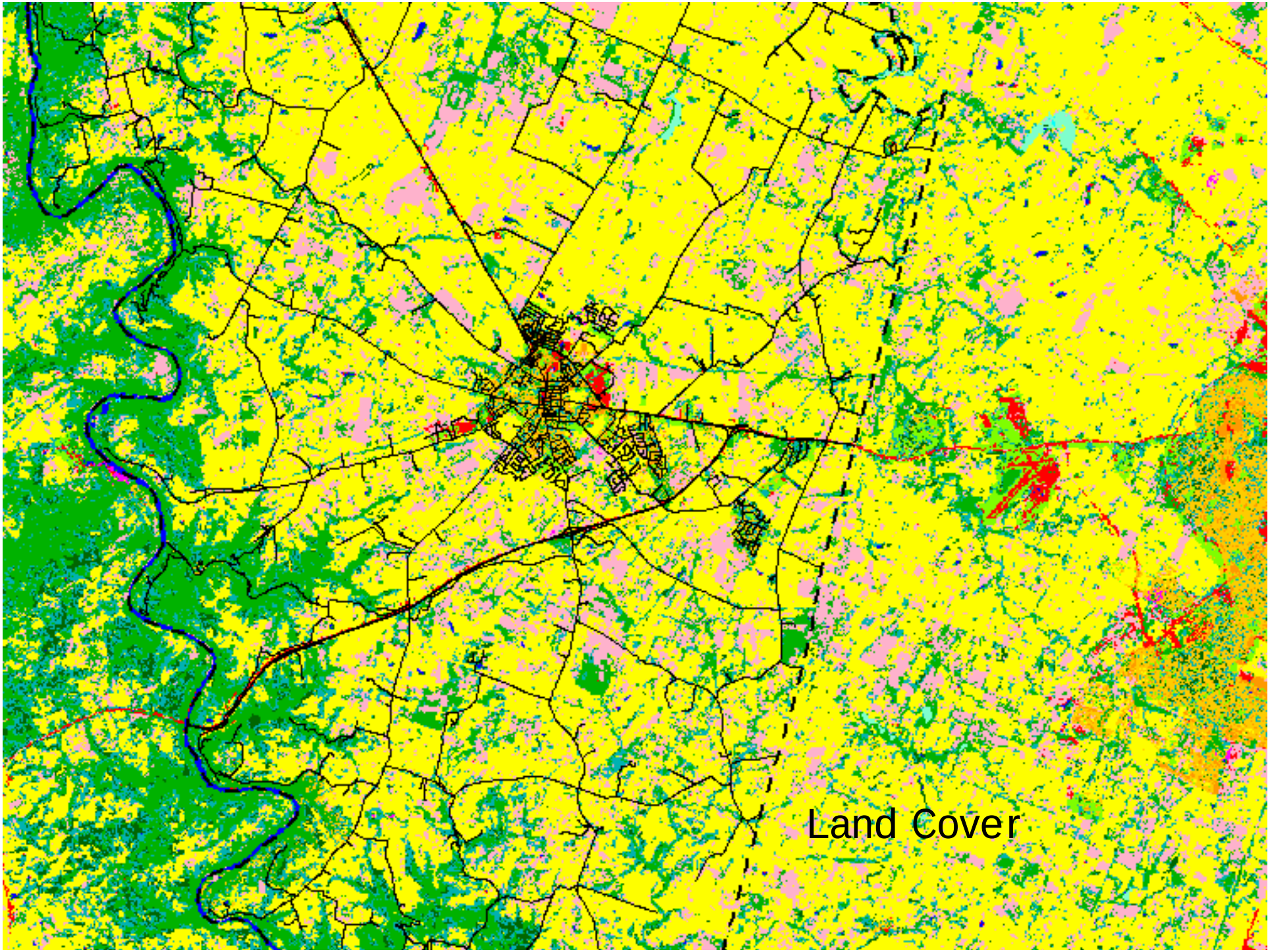


Census

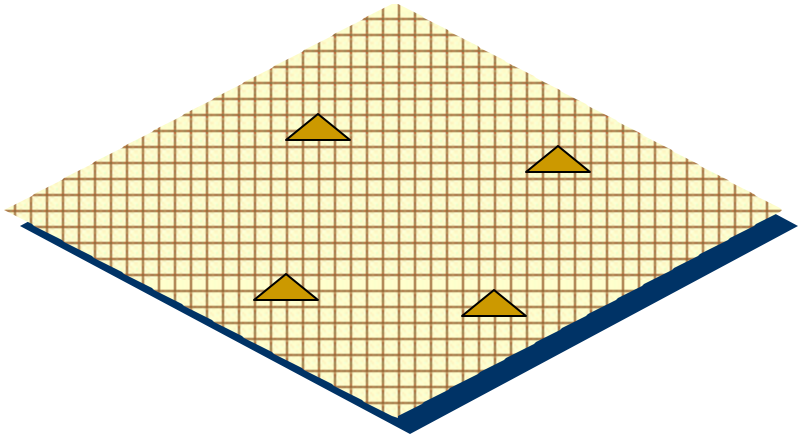
Land Cover

Demographic inventory (people, economic activity, etc.) and Landscape inventory (physical land cover—via satellite imagery)


Census Tracts
and Blocks


Land Cover

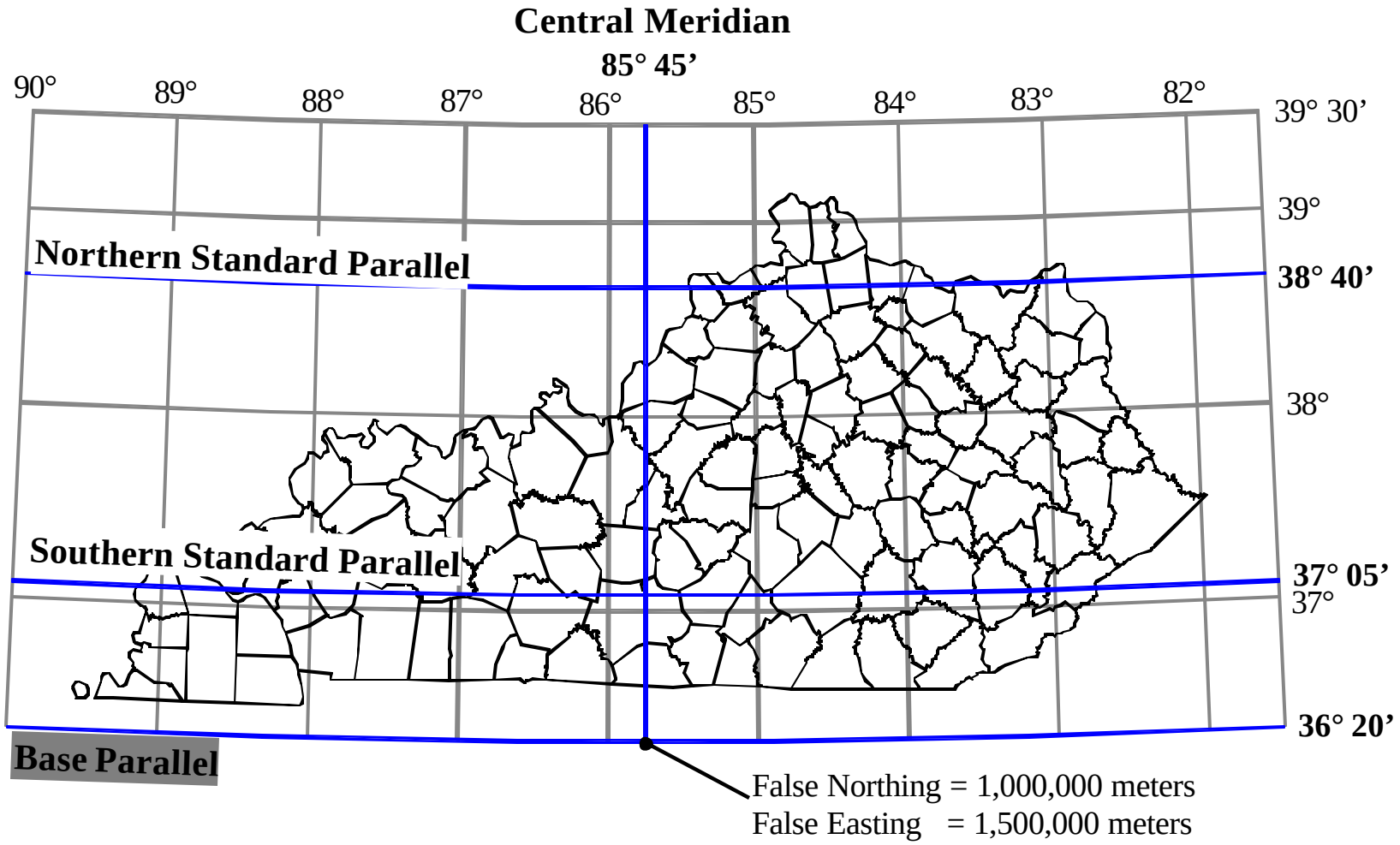
Geodetic Control layer

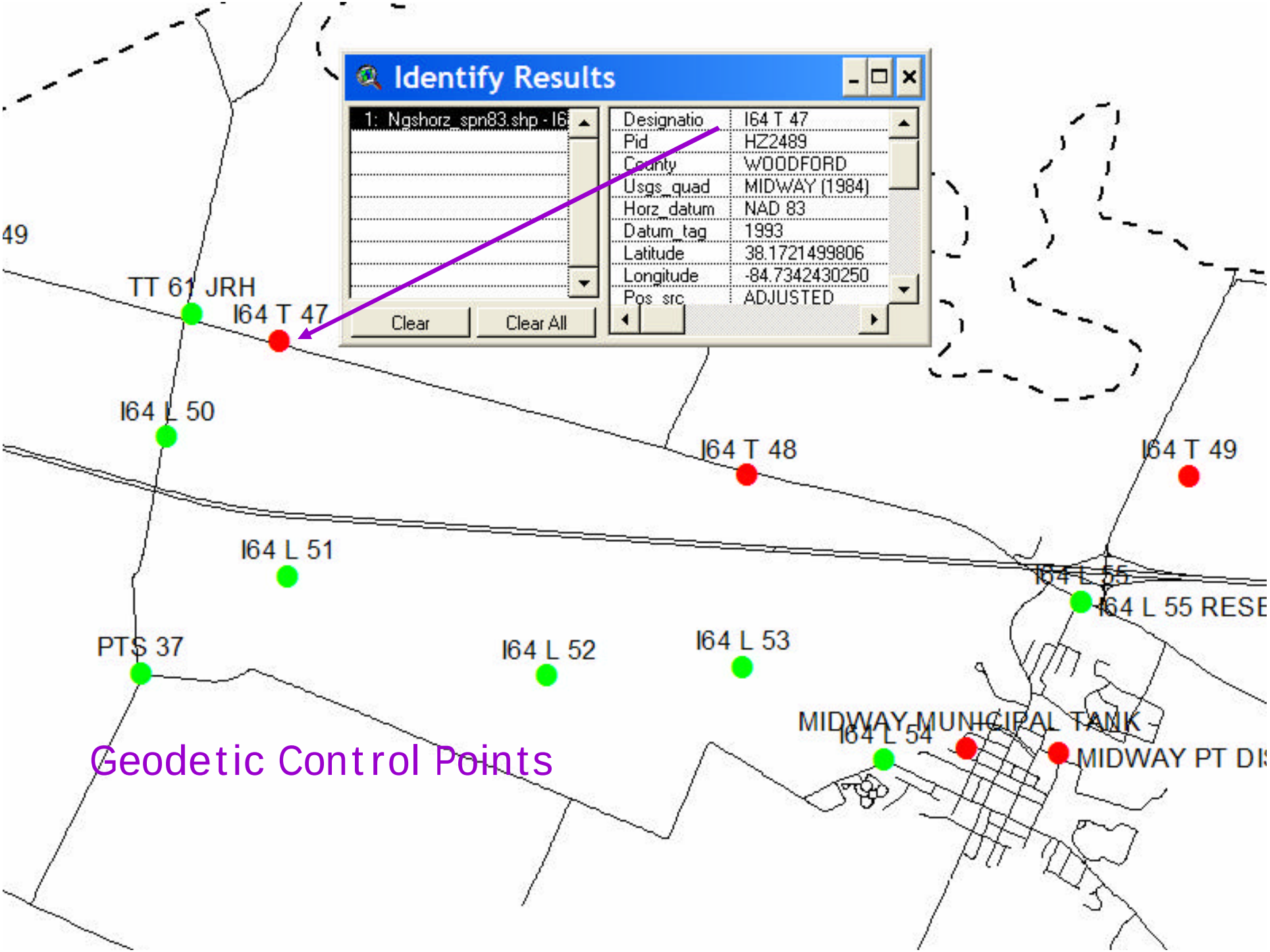


Geodesy

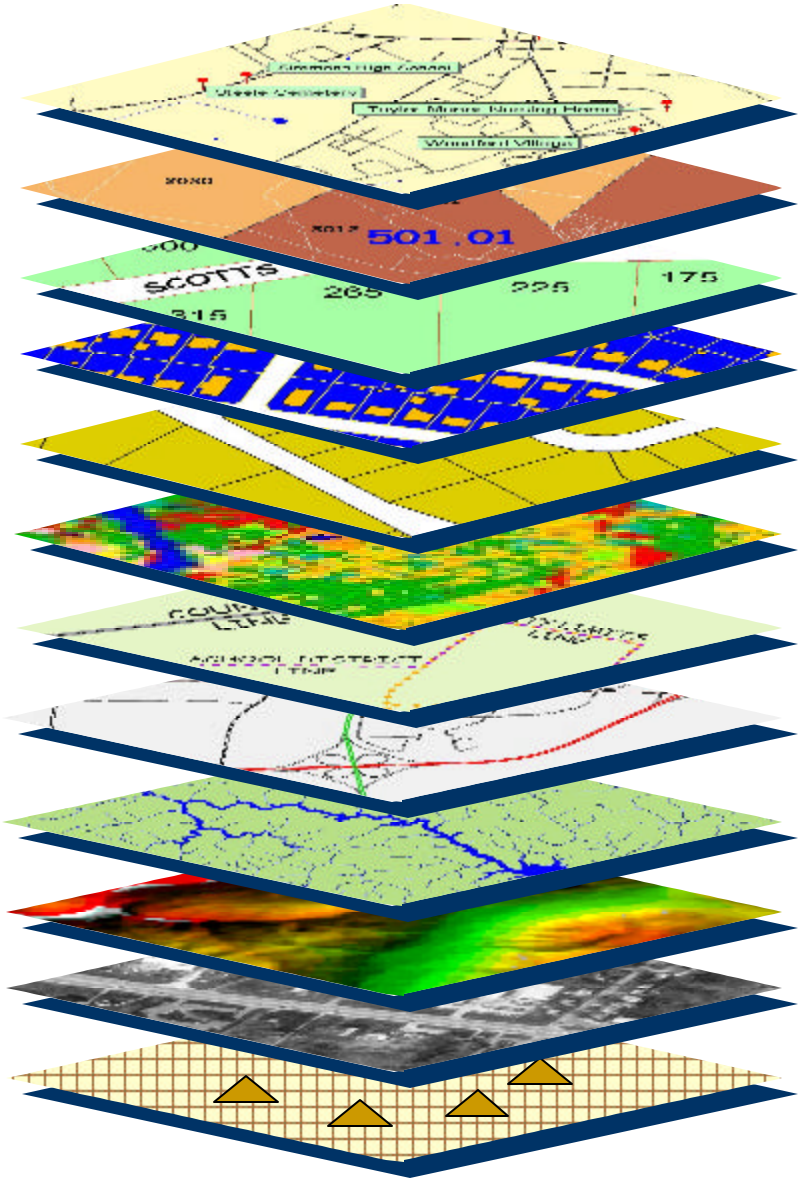
Provides the “framework” to make all the other data layers fit together—the transparent layer

STATE PLANE COORDINATE SYSTEM
SINGLE ZONE




Identify Results
1: Ngshorz_spn83.shp - I6
Designatio
I64 T 47
Pid
HZ2489
County
WOODFORD
Usgs_quad
MIDWAY (1984)
Horz_datum
NAD 83
Datum_tag
1993
Latitude
38.1721499806
Longitude
-84.7342430250
Pos_src
ADJUSTED
Clear
Clear All
49
TT 61 JRH
I64 T 47
I64 L 50
I64 T 48
I64 T 49
I64 L 51
I64 L 55
I64 L 55 RESE
PTS 37
I64 L 52
I64 L 53
MIDWAY MUNICIPAL TANK
I64 L 54
MIDWAY PT DI
Geodetic Control Points

"THE COMMONWEALTH MAP"



Geographic Names*

Census

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Structures*

Parcels

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Transportation*

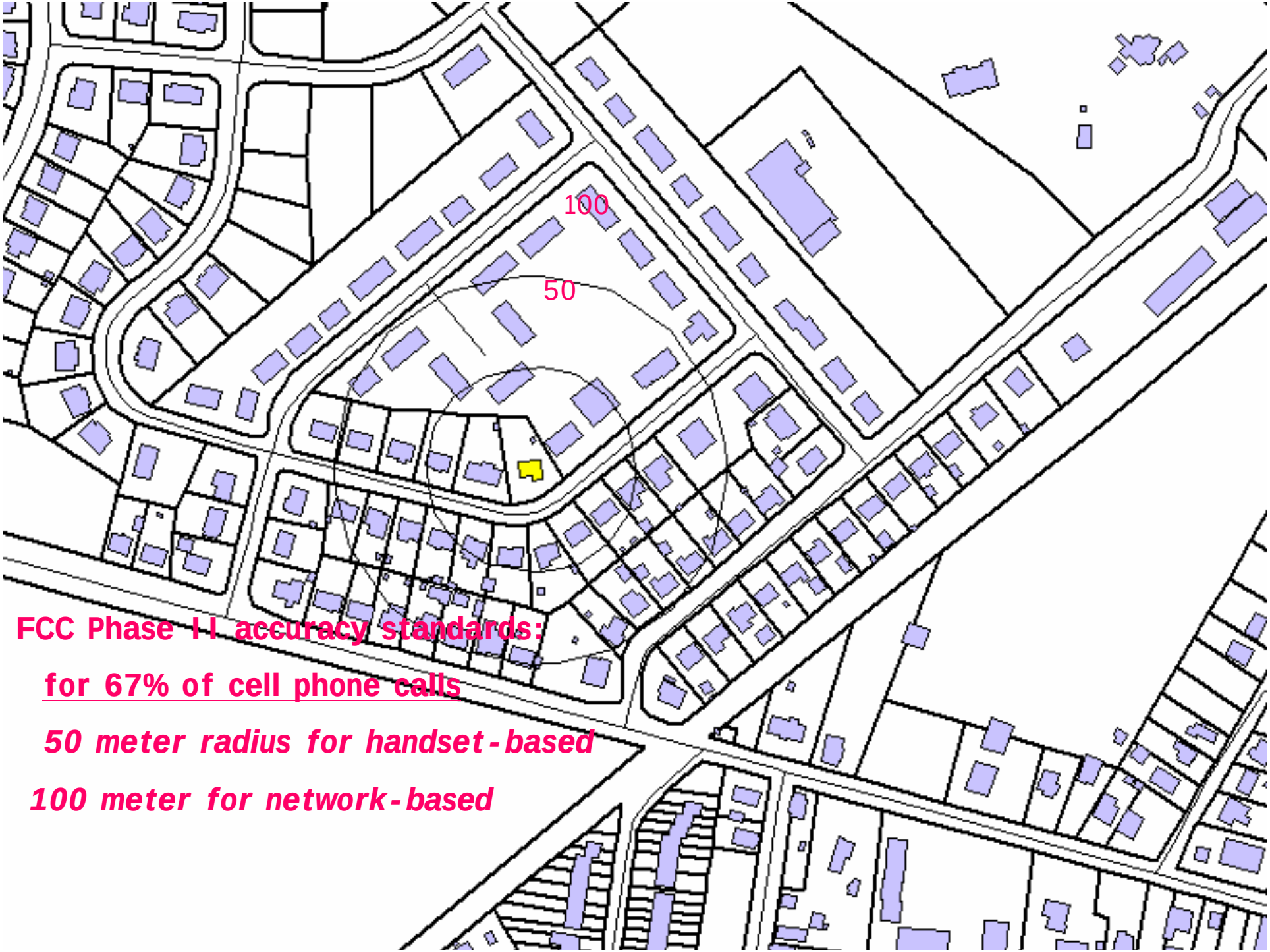
Hydrography*

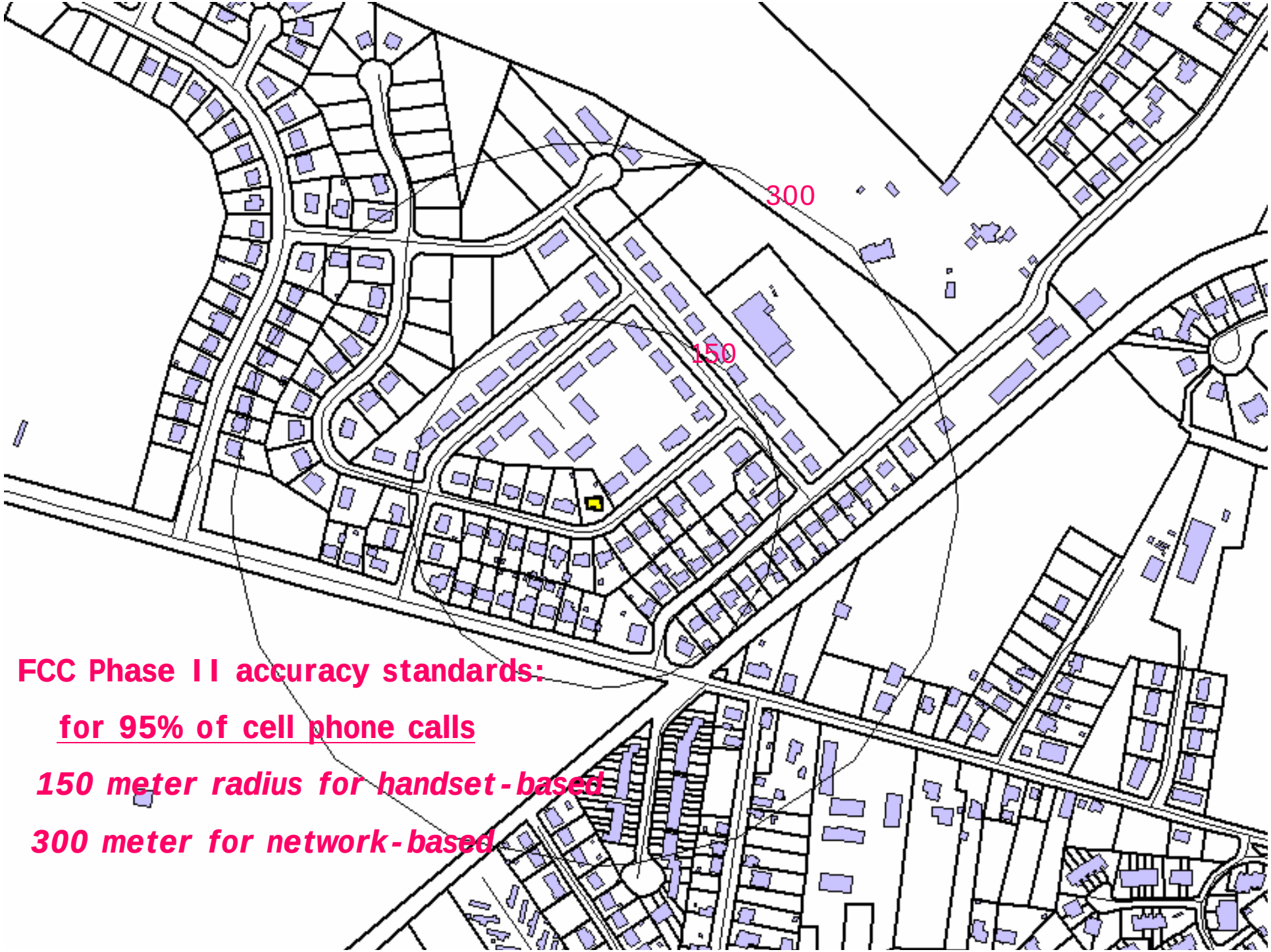
Elevation*

Orthoimagery*

Geodesy

*The National Map Layer


100
50
FCC Phase II accuracy standards:
for 67% of cell phone calls
50 meter radius for handset-based
100 meter for network-based

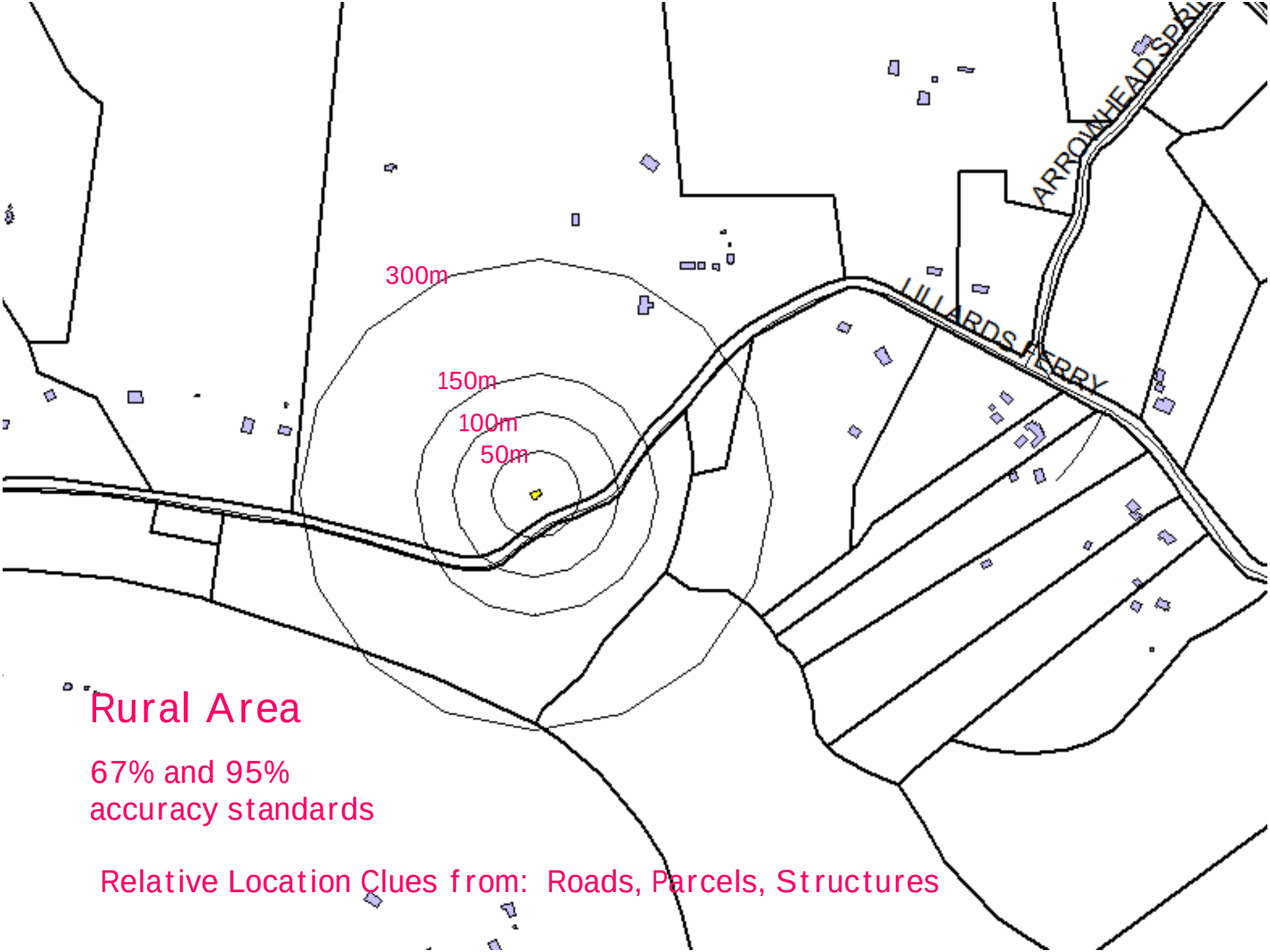


FCC Phase II accuracy standards:

for 95% of cell phone calls

150 meter radius for handset-based

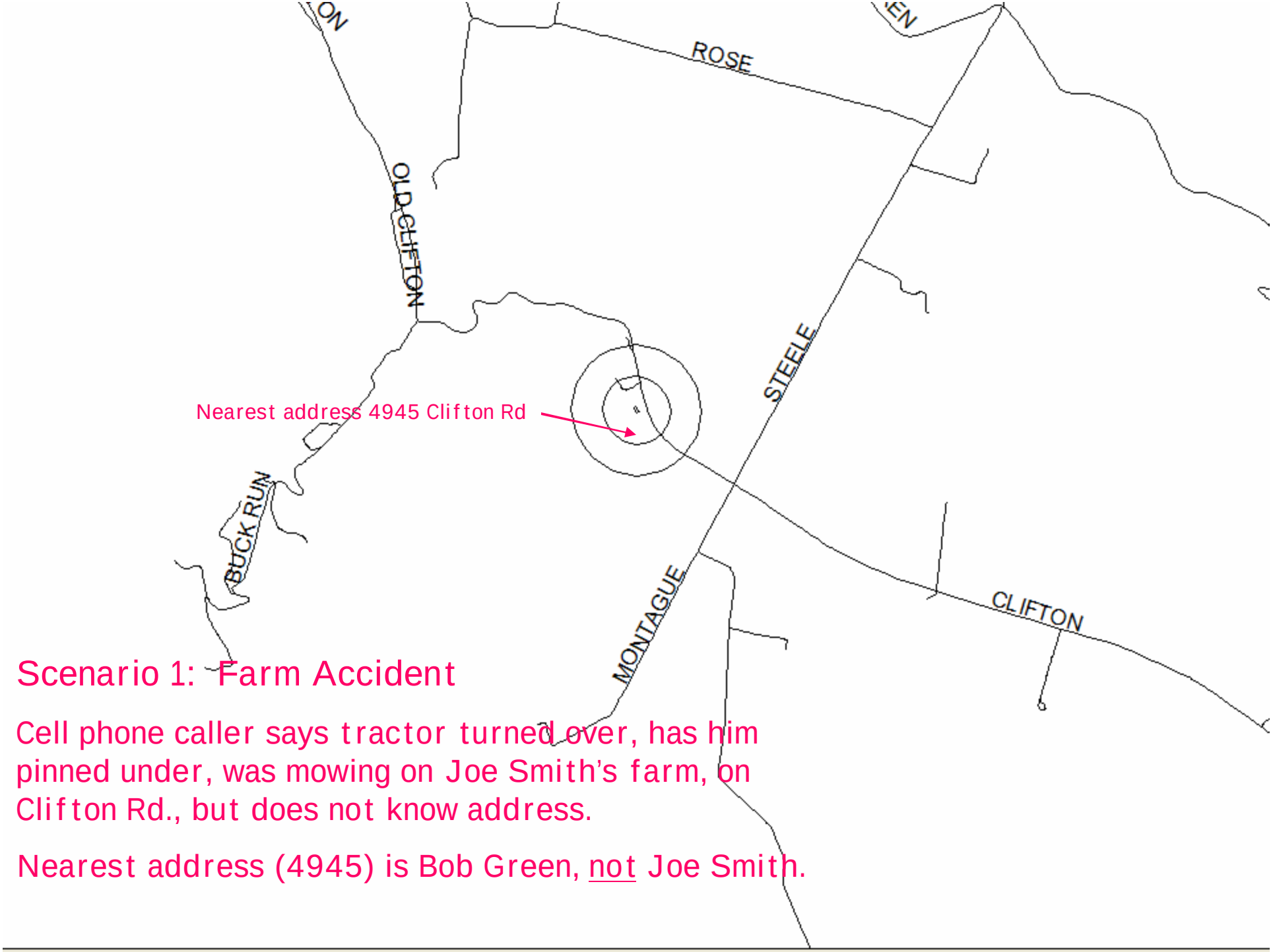
300 meter for network-based


300m
150m
100m
50m
ARROWHEAD SPRI
LILLARDS FERRY
Rural Area
67% and 95%
accuracy standards
Relative Location Clues from: Roads, Parcels, Structures


ARROWHEAD SPRI
LILLARDS FERRY
Add Orthoimagery


ARROWHEAD SPR
HILLARDS FERRY
Add Hydrography

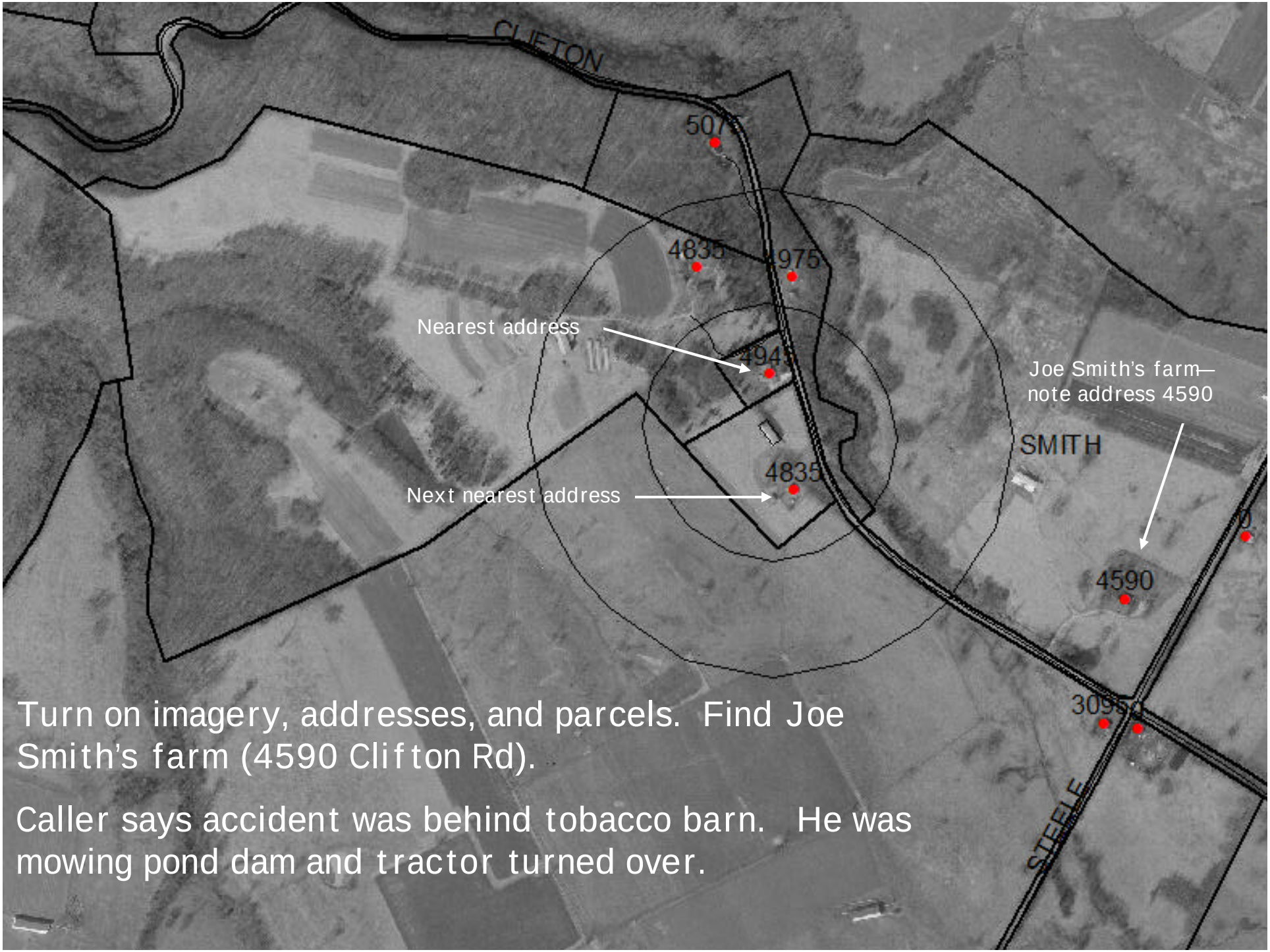

ARROWHEAD SPRI
HEARDS FERRY
Add Elevaton (Contour Lines)



Scenario 1: Farm Accident

Cell phone caller says tractor turned over, has him pinned under, was mowing on Joe Smith's farm, on Clifton Rd., but does not know address.

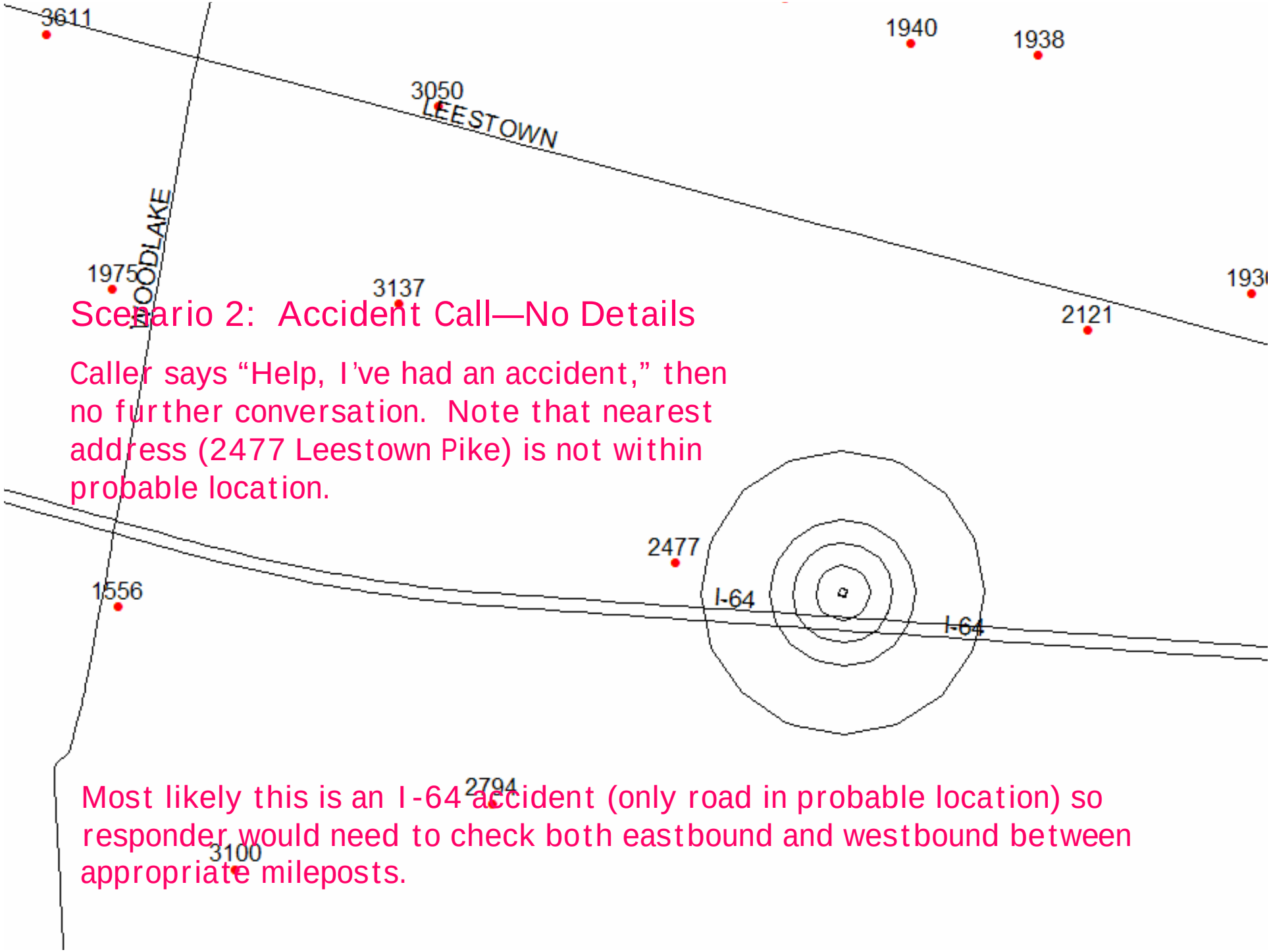
Nearest address (4945) is Bob Green, not Joe Smith.



Turn on imagery, addresses, and parcels. Find Joe Smith's farm (4590 Clifton Rd).

Caller says accident was behind tobacco barn. He was mowing pond dam and tractor turned over.

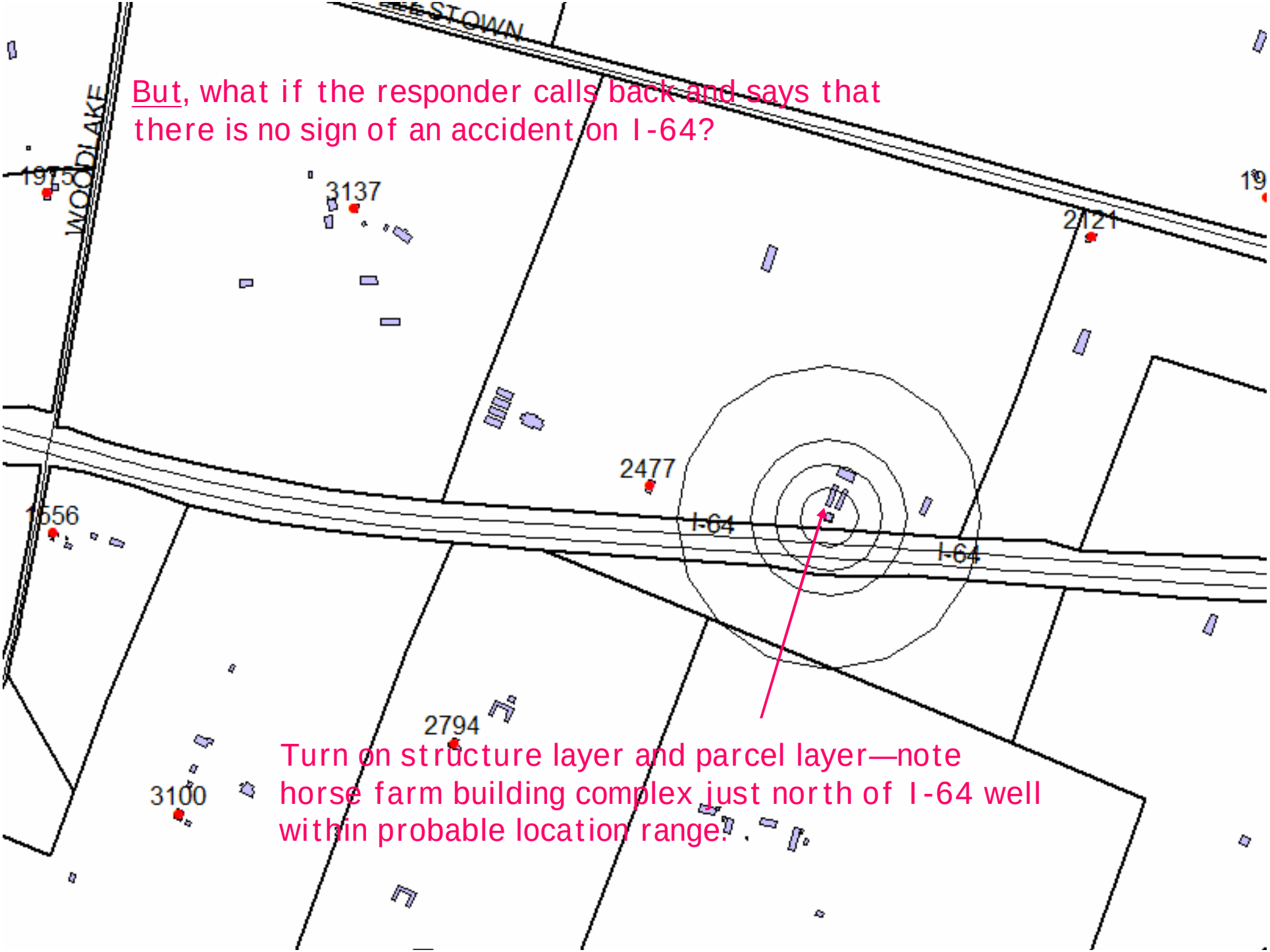

5075
4835
4975
3585
4945
Probable accident location
4835
0
4590
3095
Turn on structures and hydrography—two tobacco barns, but only one with pond behind.
Location found, also best access to accident site visible on orthoimagery (take driveway toward house, turn left on lane across field to tobacco barn, pond behind barn).

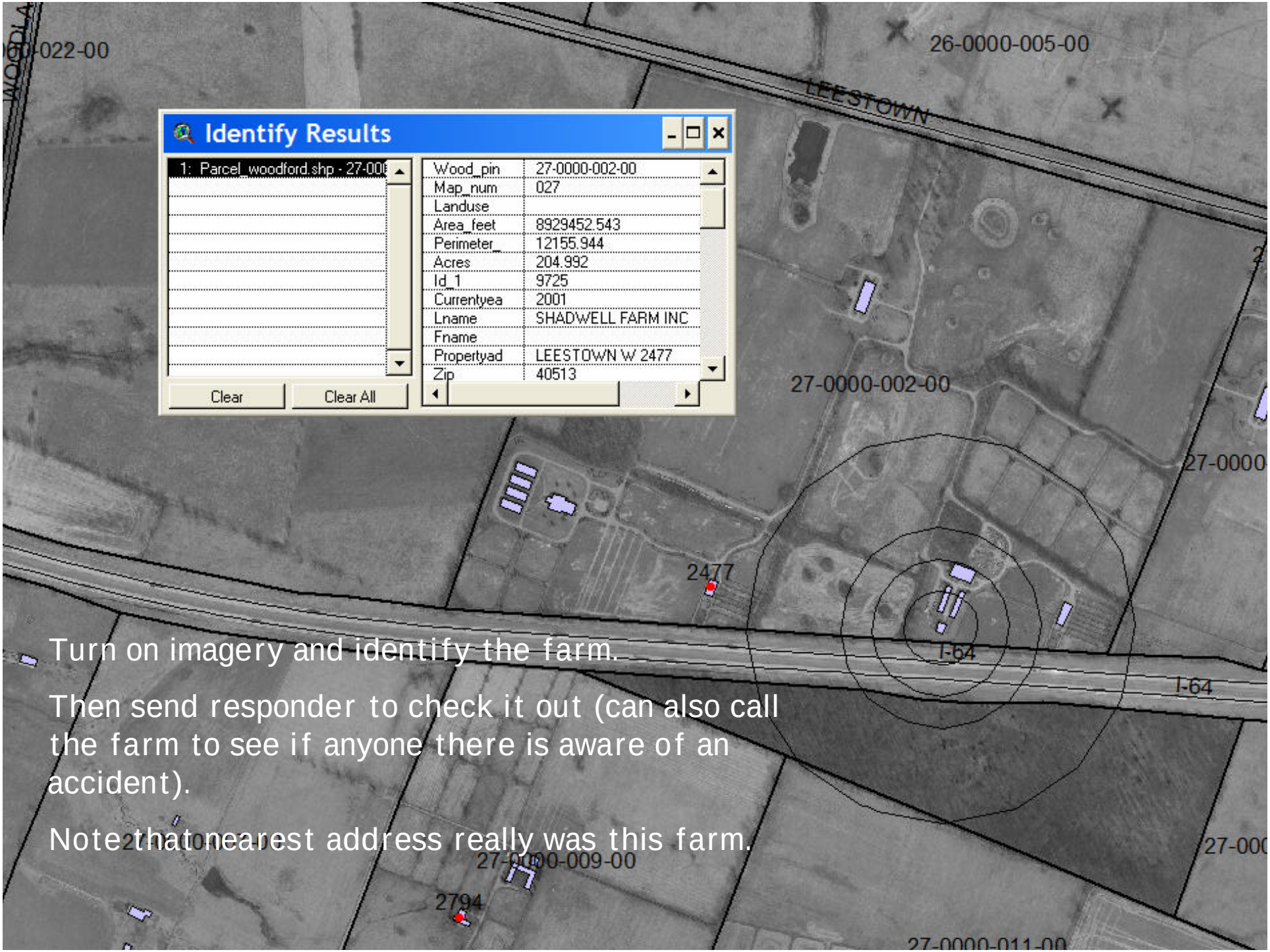


Scenario 2: Accident Call—No Details

Caller says "Help, I've had an accident," then no further conversation. Note that nearest address (2477 Leestown Pike) is not within probable location.

Most likely this is an I-64 accident (only road in probable location) so responder would need to check both eastbound and westbound between appropriate mileposts.


But, what if the responder calls back and says that there is no sign of an accident on I-64?
WOODLAKE
3137
2121
2477
1556
I-64
I-64
2794
3100
Turn on structure layer and parcel layer—note horse farm building complex just north of I-64 well within probable location range!



Turn on imagery and identify the farm.

Then send responder to check it out (can also call the farm to see if anyone there is aware of an accident).

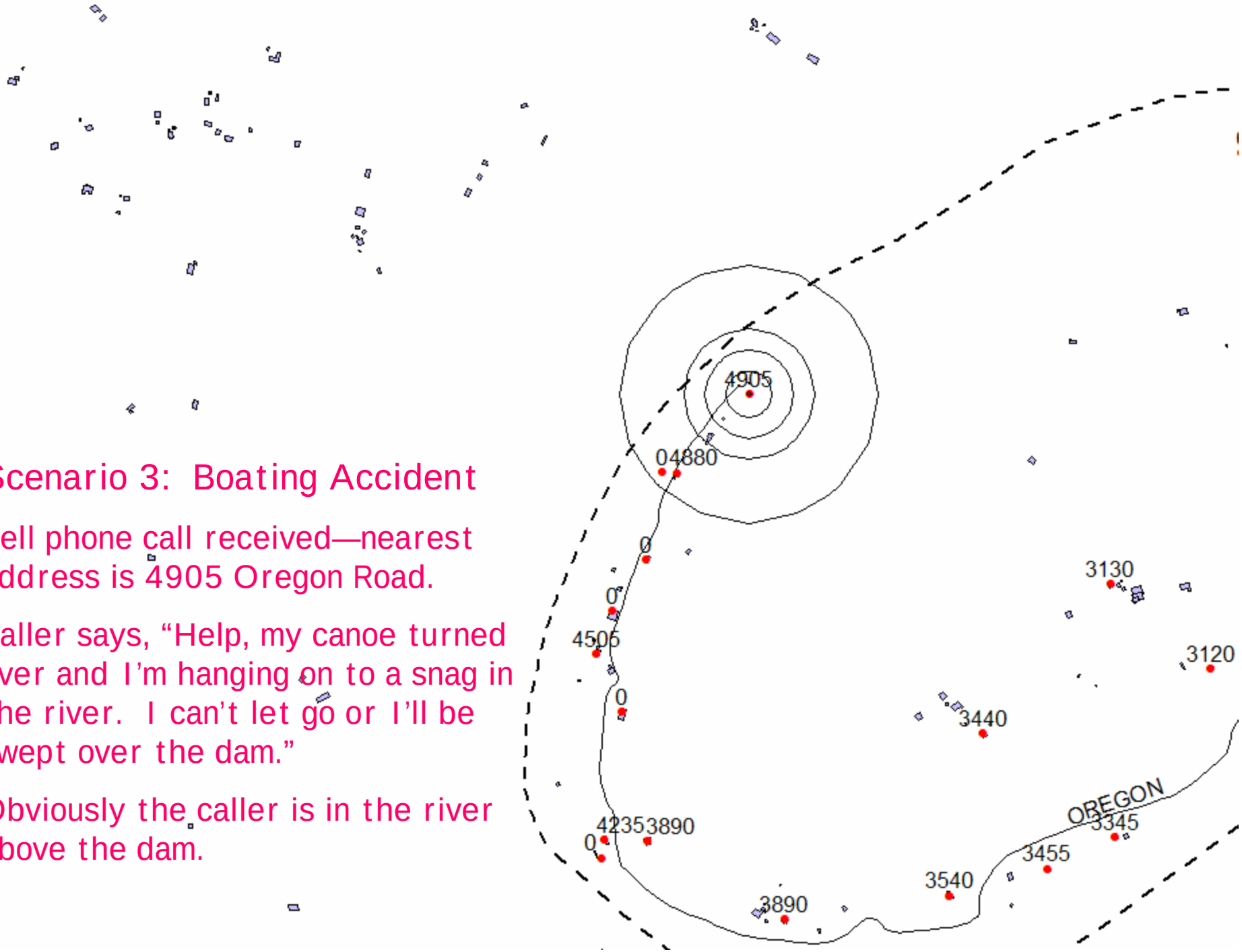
Note that nearest address really was this farm.

Scenario 3: Boating Accident

Cell phone call received—nearest address is 4905 Oregon Road.

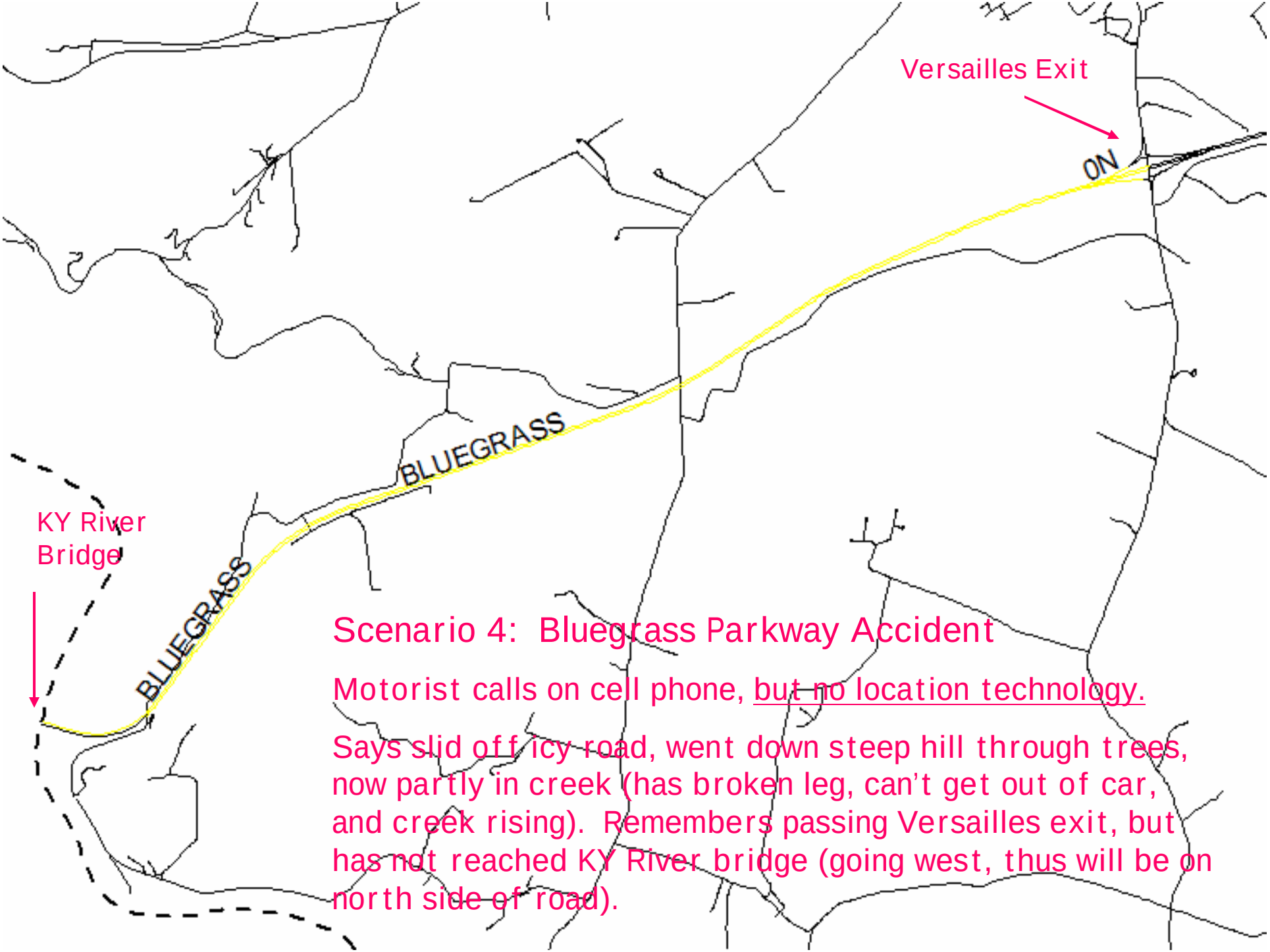
Caller says, “Help, my canoe turned over and I’m hanging on to a snag in the river. I can’t let go or I’ll be swept over the dam.”

Obviously the caller is in the river above the dam.




Turn on orthoimagery.
Zoom in on area—note lock and dam.
When asked, caller says that he is on the lock side of the river, just above the lock headwall.

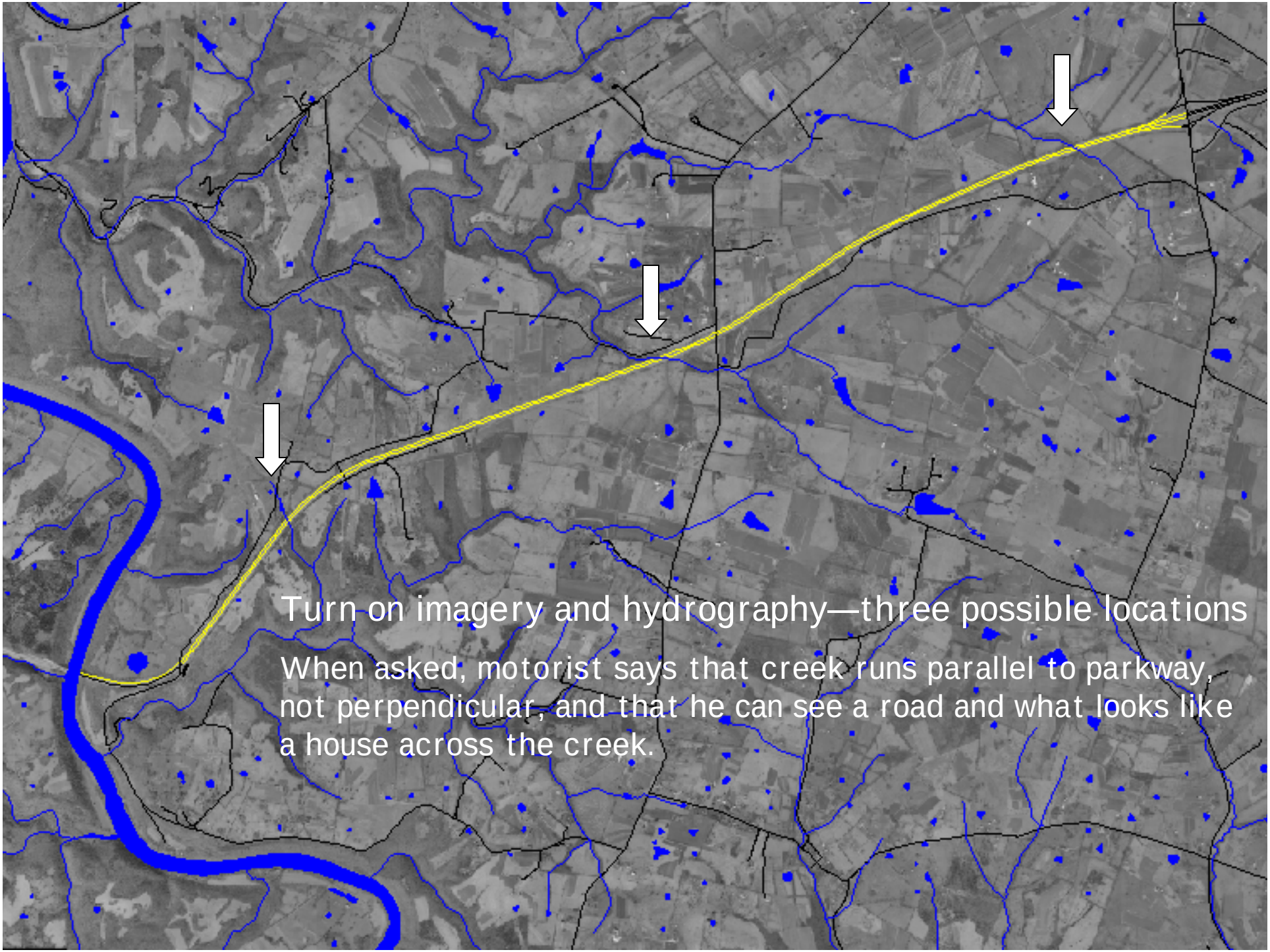

Zoom in again.
Note probable location of canoeist just above dam and lock headwall.
(Remember that the name of the road and the address of the nearest house has already been determined.)

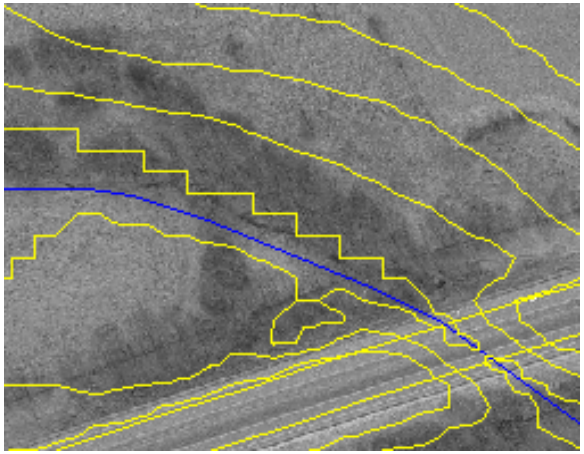


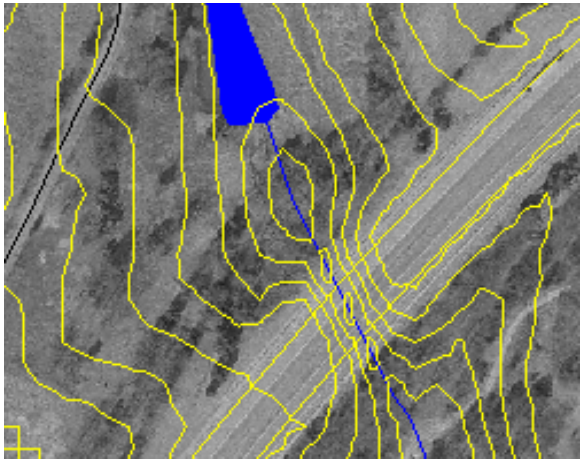
Scenario 4: Bluegrass Parkway Accident

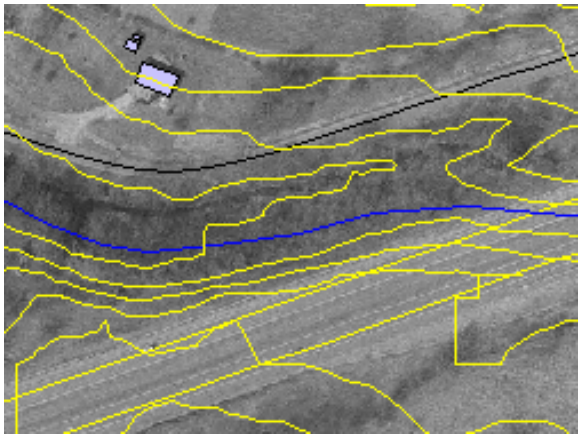
Motorist calls on cell phone, but no location technology.

Says slid off icy road, went down steep hill through trees, now partly in creek (has broken leg, can't get out of car, and creek rising). Remembers passing Versailles exit, but has not reached KY River bridge (going west, thus will be on north side of road).


Turn on imagery and hydrography—three possible locations
When asked, motorist says that creek runs parallel to parkway, not perpendicular, and that he can see a road and what looks like a house across the creek.





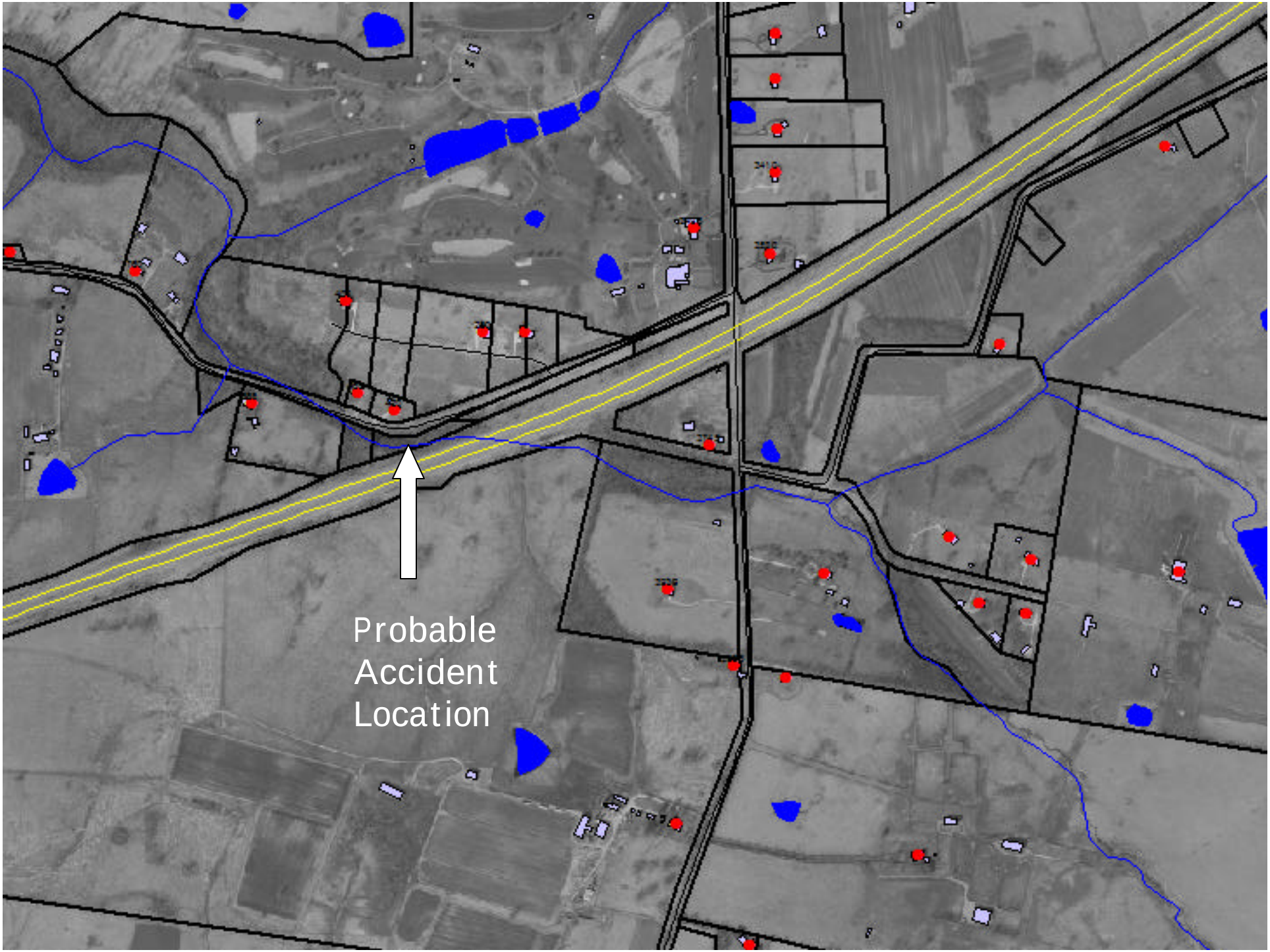


Turn on contour lines and structures
(zoom in on the three possible sites)

1) No steep hill, no road or house

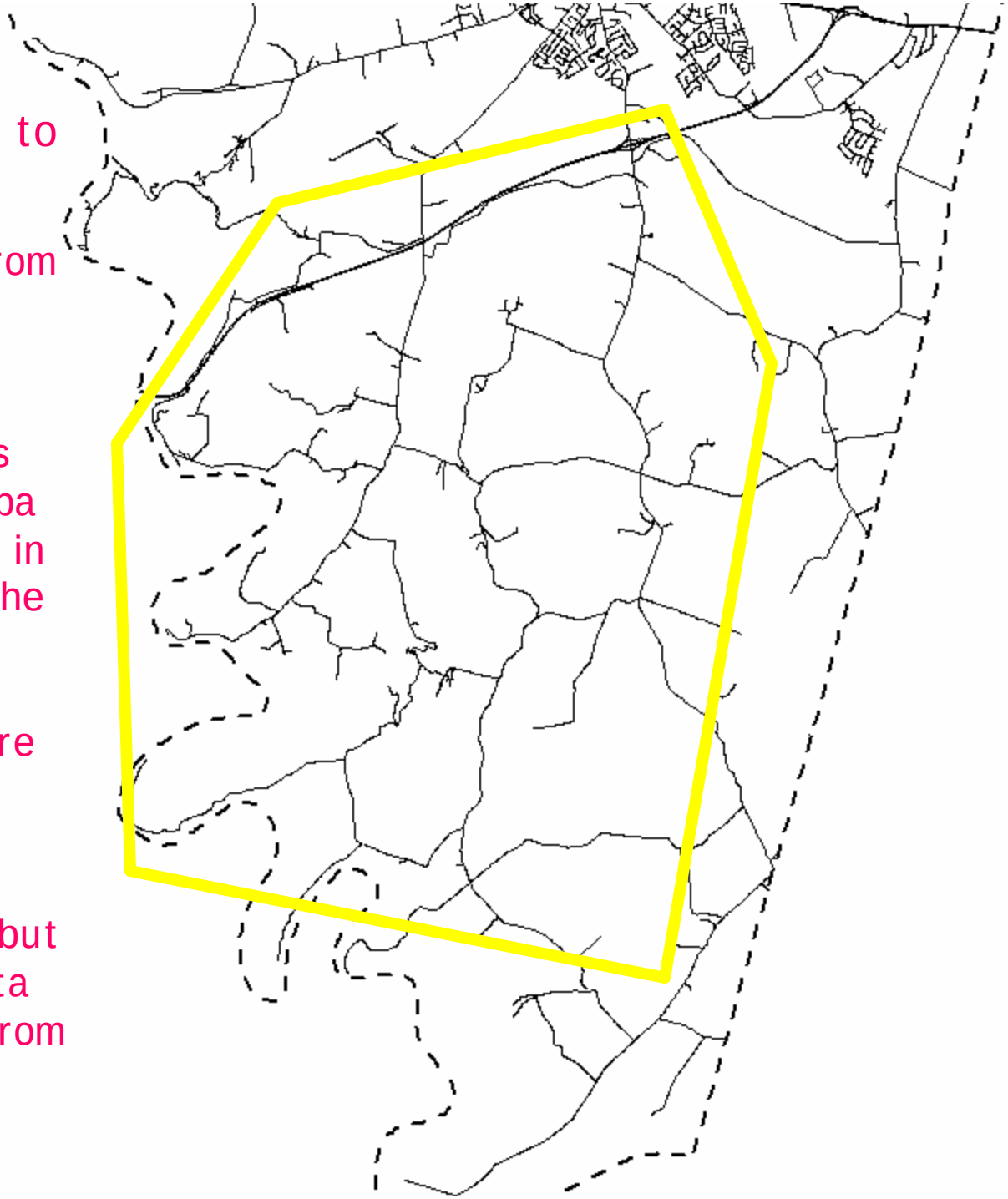
2) Steep hill, but creek not parallel to parkway, also no road or house

3) Steep hill, creek parallel to parkway, and both road and house—obviously **this is the best choice**

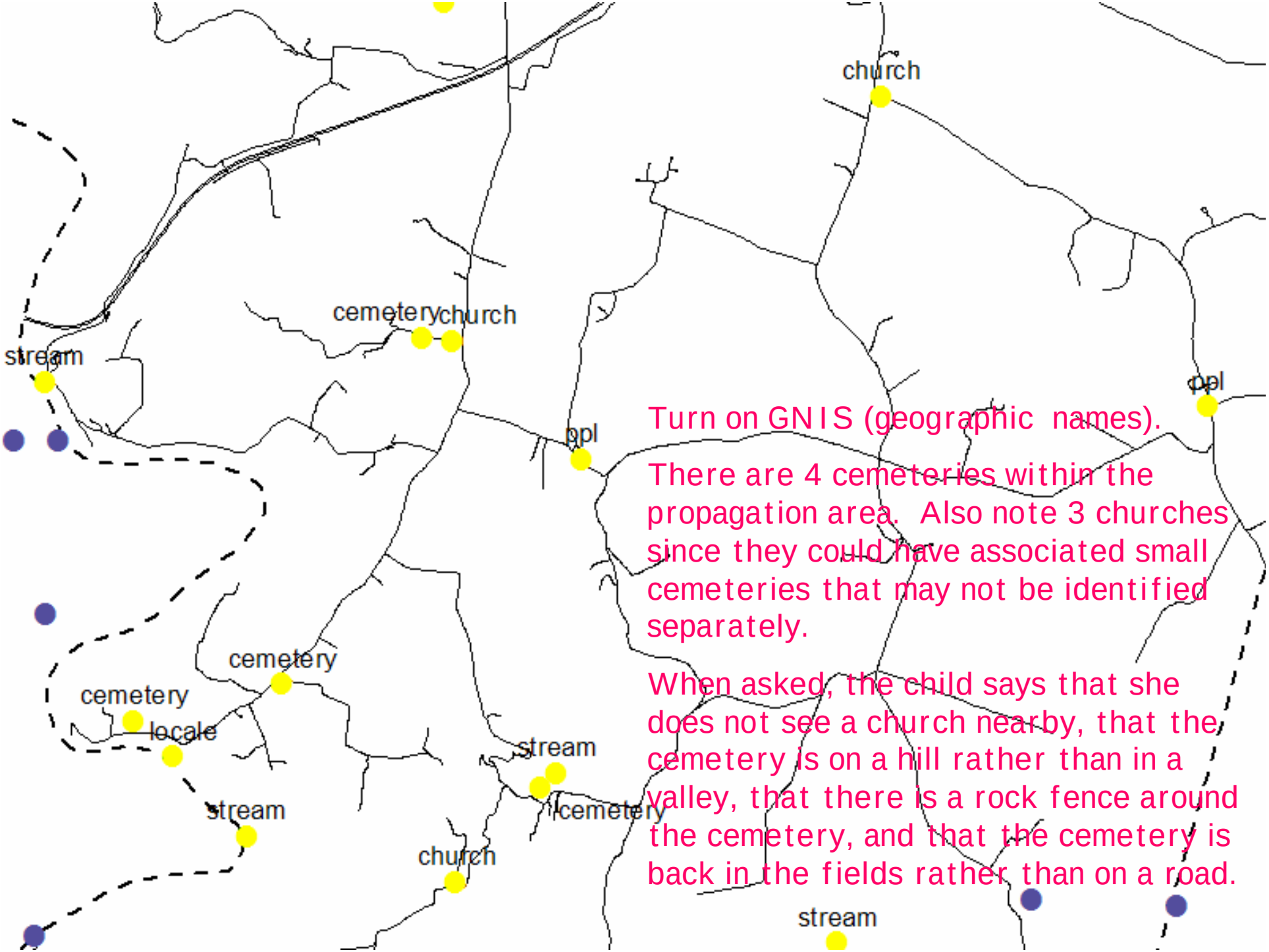

Probable
Accident
Location

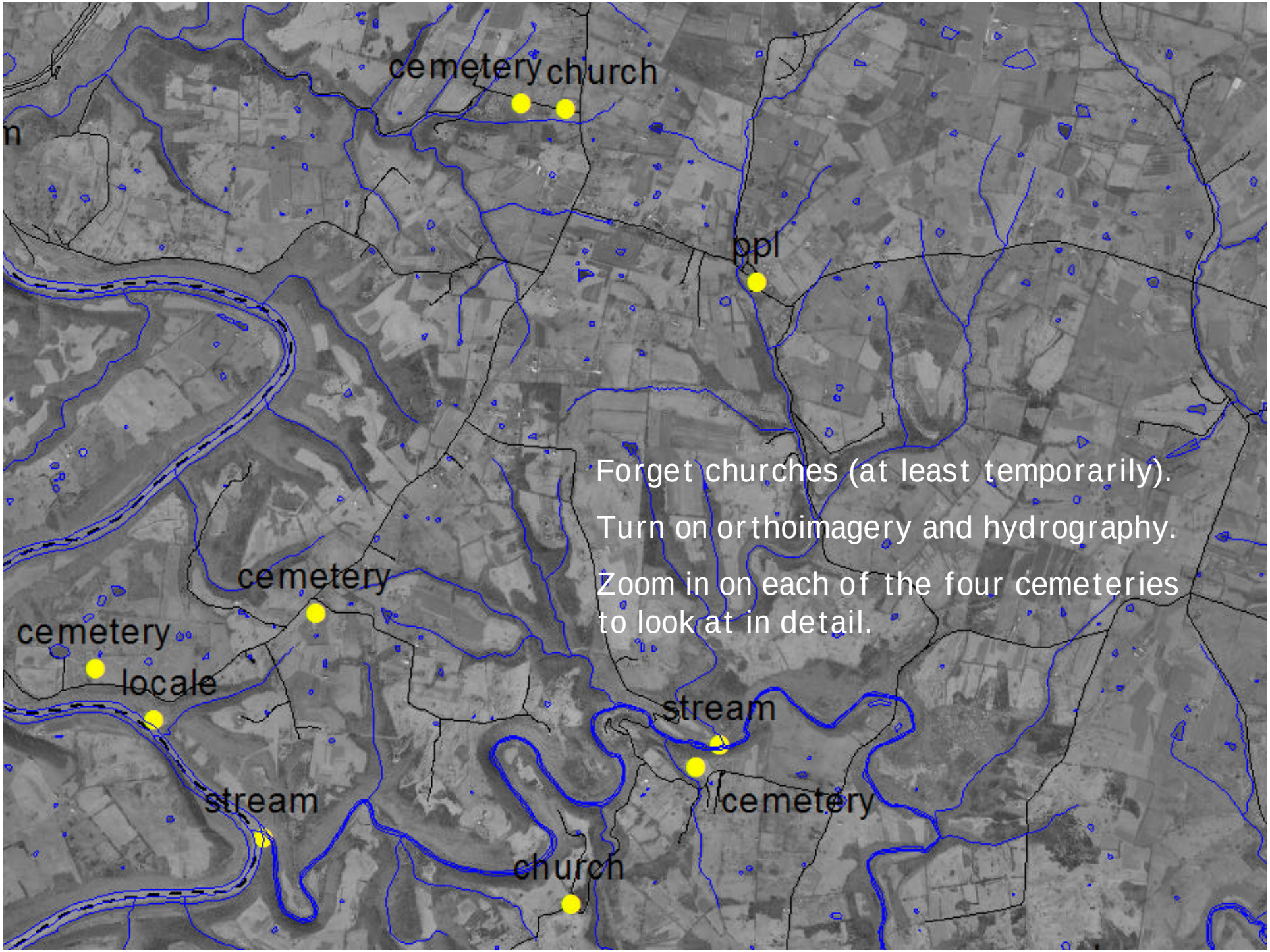
Scenario 5: Reference to Geographic Names

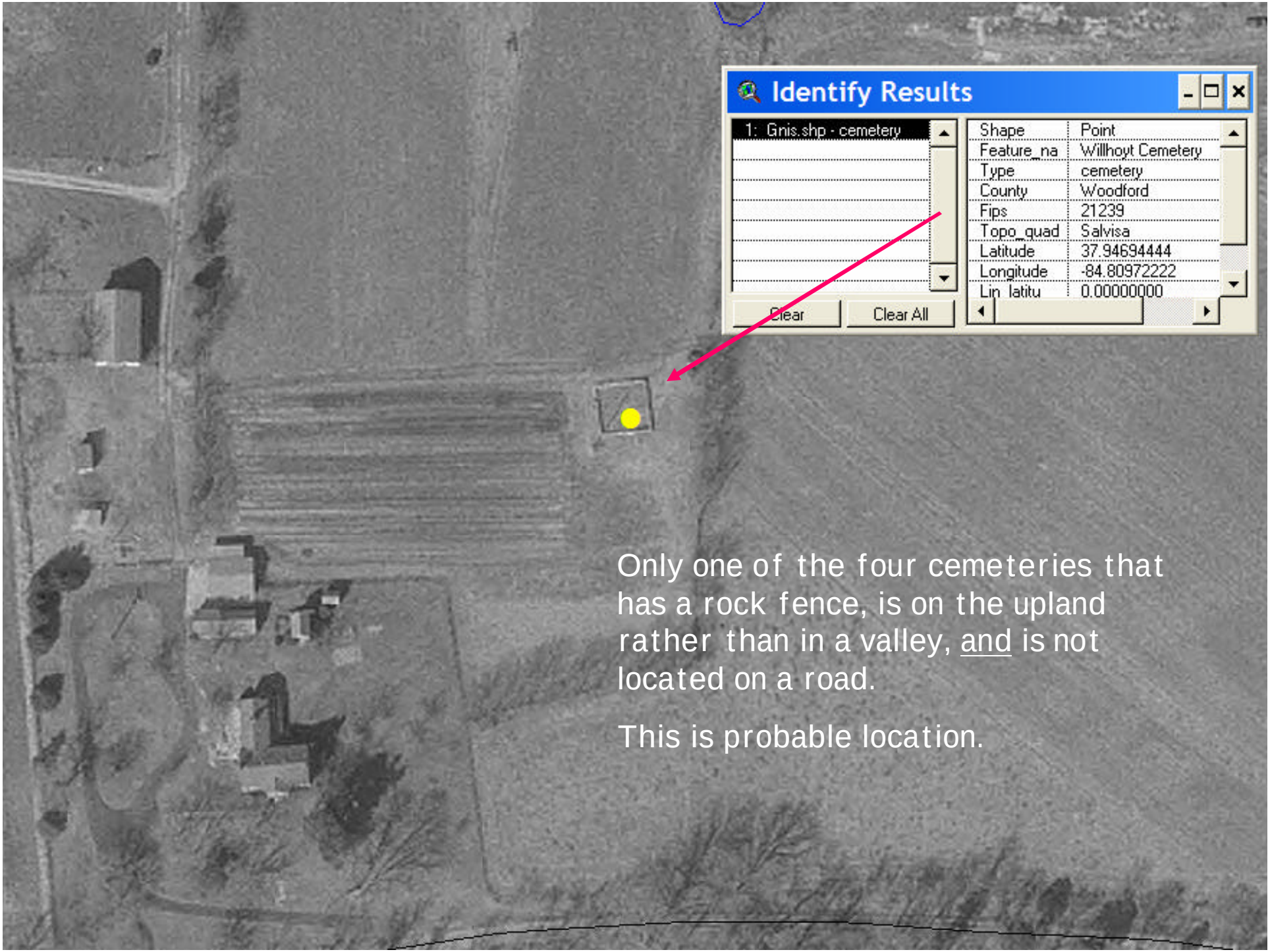
Cell phone call received from a child. It is a hot day in July and she says that Grandpa just passed out. When questioned she says that she went with Grandpa to a cemetery somewhere in the country to clean off the old family graves. She doesn't know what the cemetery is called or where she is.

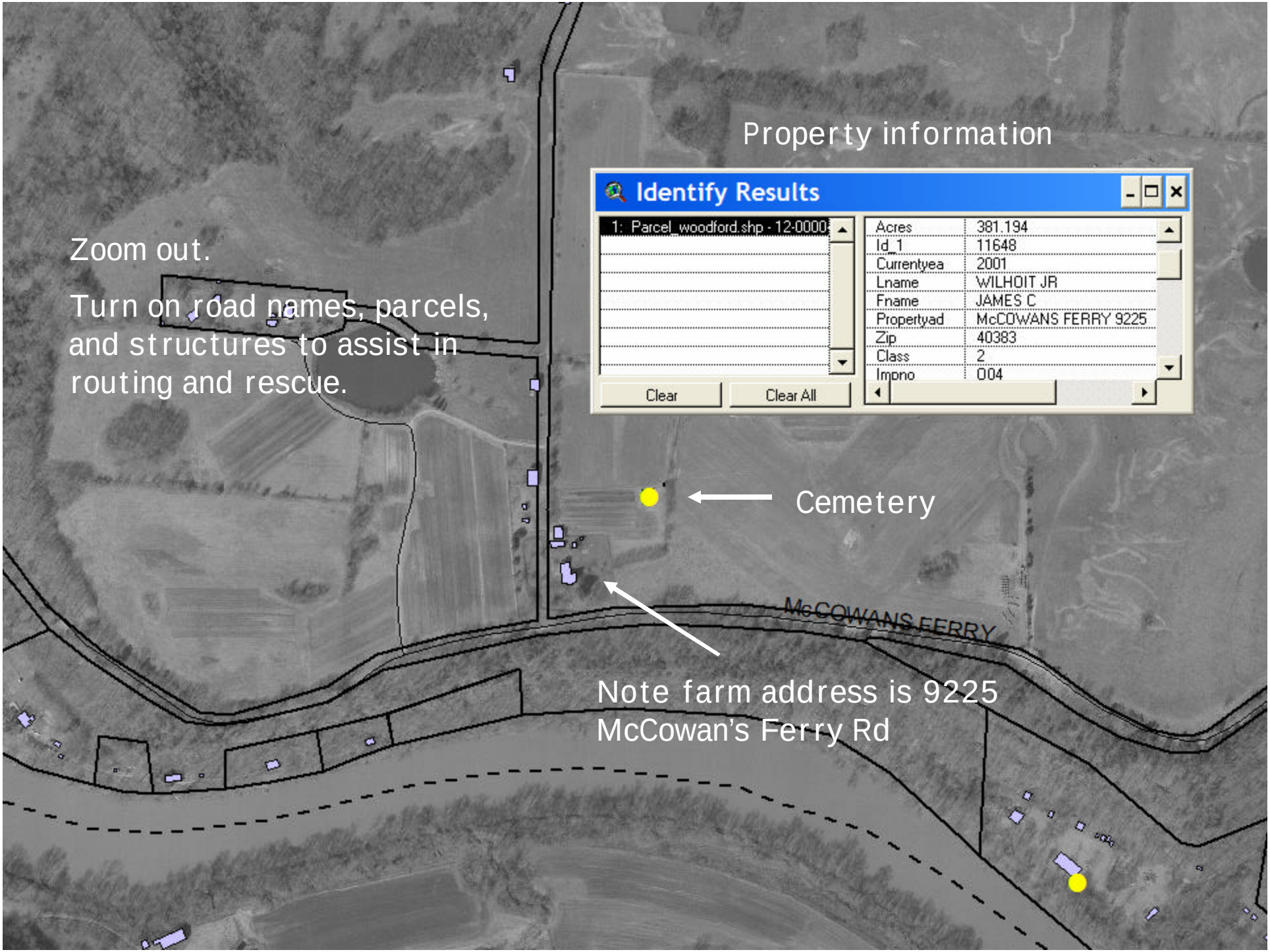


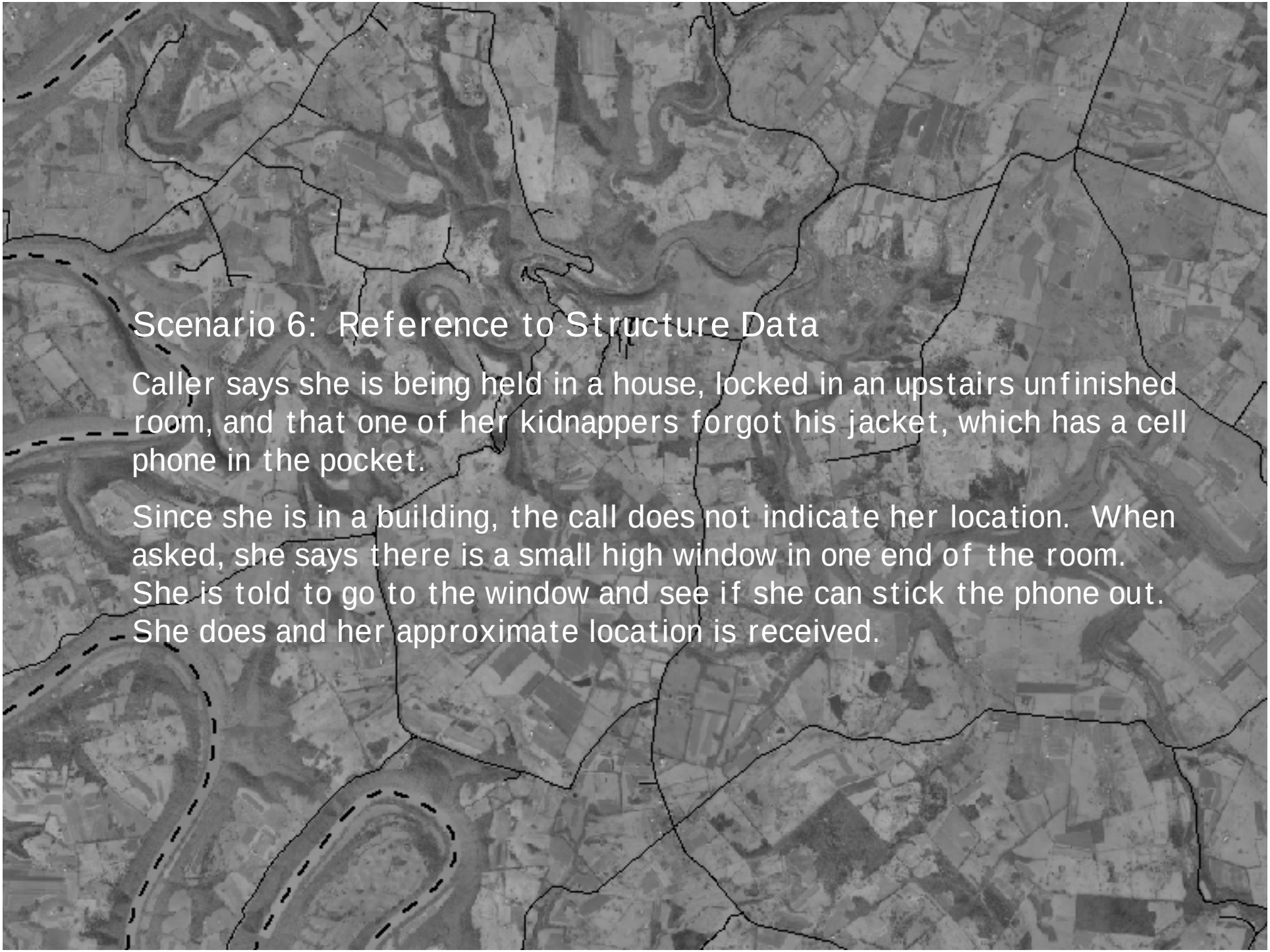
No coordinates received, but cell tower propagation data indicates that call came from within the area outlined.


church
cemetery
church
stream
ppl
ppl
cemetery
cemetery
locale
stream
stream
cemetery
church
stream
Turn on GNIS (geographic names).
There are 4 cemeteries within the propagation area. Also note 3 churches since they could have associated small cemeteries that may not be identified separately.
When asked, the child says that she does not see a church nearby, that the cemetery is on a hill rather than in a valley, that there is a rock fence around the cemetery, and that the cemetery is back in the fields rather than on a road.


cemetery
church
n
ppl
Forget churches (at least temporarily).
Turn on orthoimagery and hydrography.
Zoom in on each of the four cemeteries to look at in detail.
cemetery
cemetery
locale
stream
stream
cemetery
church


Identify Results
1: Gnis.shp - cemetery
Shape Point
Feature_na Willhoyt Cemetery
Type cemetery
County Woodford
Fips 21239
Topo_quad Salvisa
Latitude 37.94694444
Longitude -84.80972222
Lin_latitu 0.00000000
Clear
Clear All
Only one of the four cemeteries that has a rock fence, is on the upland rather than in a valley, and is not located on a road.
This is probable location.

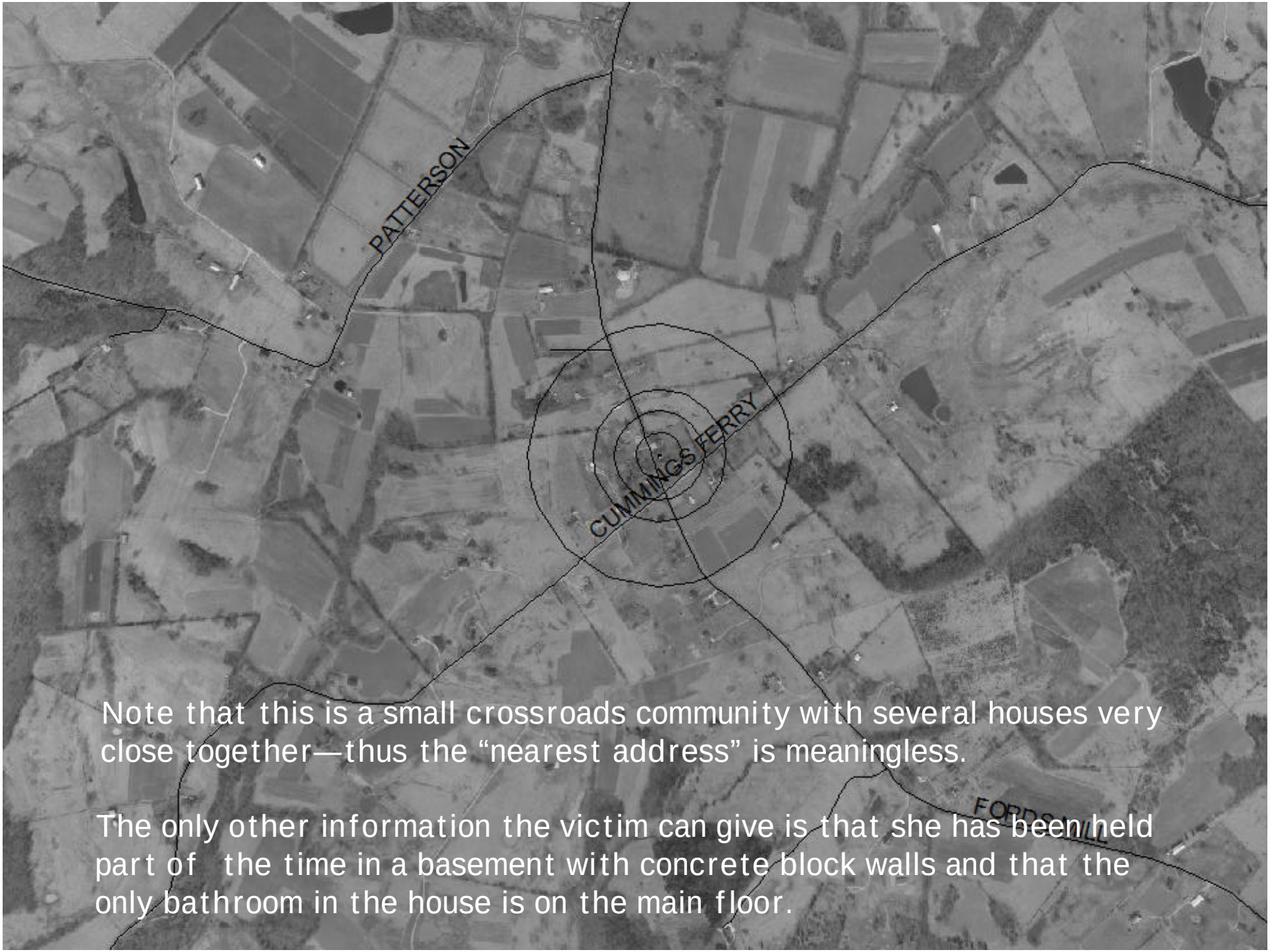

Property information
Identify Results
1: Parcel_woodford.shp - 12-0000
Acres 381.194
Id_1 11648
Currentyea 2001
Lname WILHOIT JR
Fname JAMES C
Propertyad McCOWANS FERRY 9225
Zip 40383
Class 2
Impno 004
Clear
Clear All
Zoom out.
Turn on road names, parcels, and structures to assist in routing and rescue.
Cemetery
McCOWANS FERRY
Note farm address is 9225 McCowan's Ferry Rd



Scenario 6: Reference to Structure Data

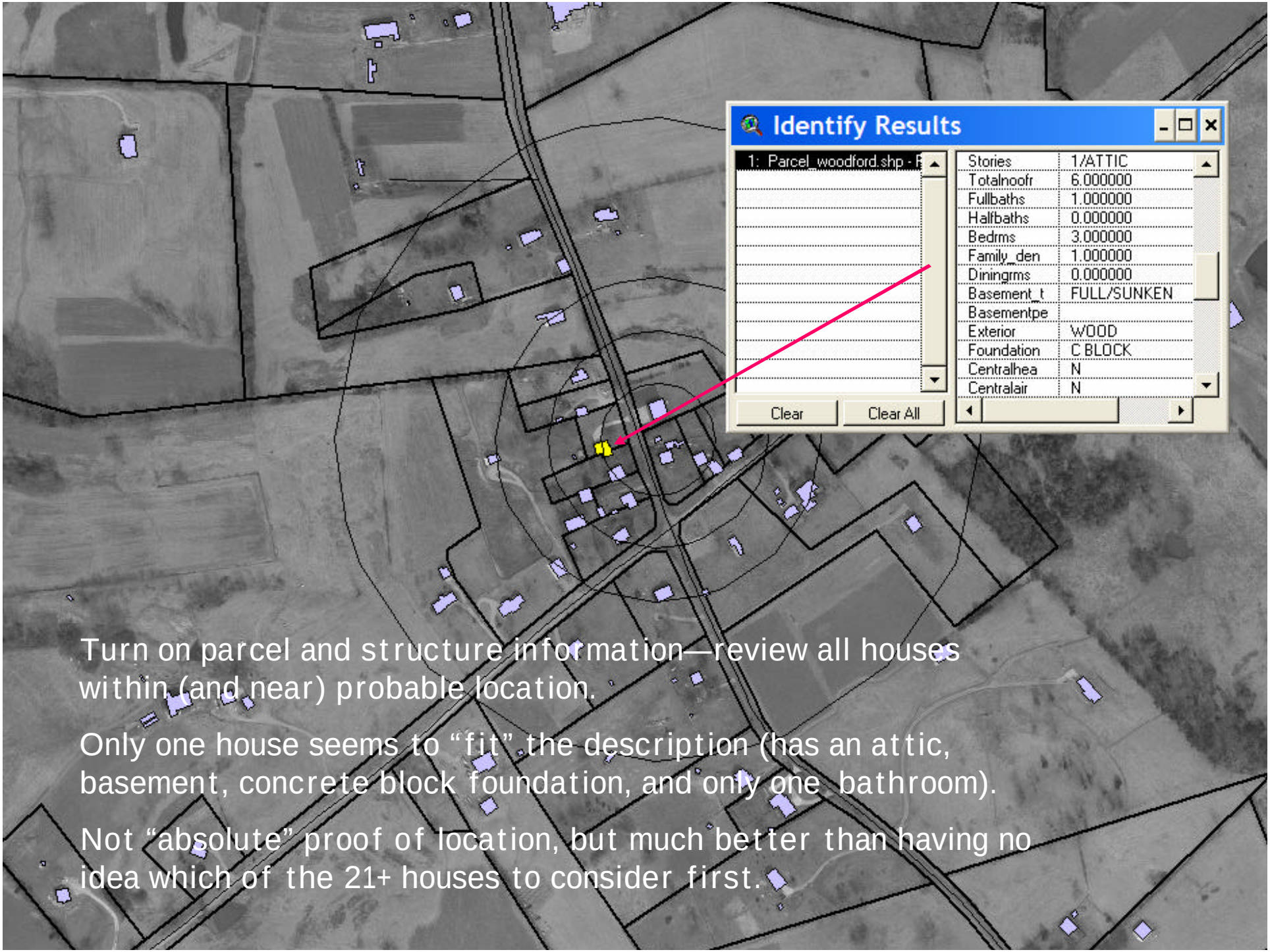
Caller says she is being held in a house, locked in an upstairs unfinished room, and that one of her kidnappers forgot his jacket, which has a cell phone in the pocket.

Since she is in a building, the call does not indicate her location. When asked, she says there is a small high window in one end of the room. She is told to go to the window and see if she can stick the phone out. She does and her approximate location is received.



Note that this is a small crossroads community with several houses very close together—thus the “nearest address” is meaningless.

The only other information the victim can give is that she has been held part of the time in a basement with concrete block walls and that the only bathroom in the house is on the main floor.

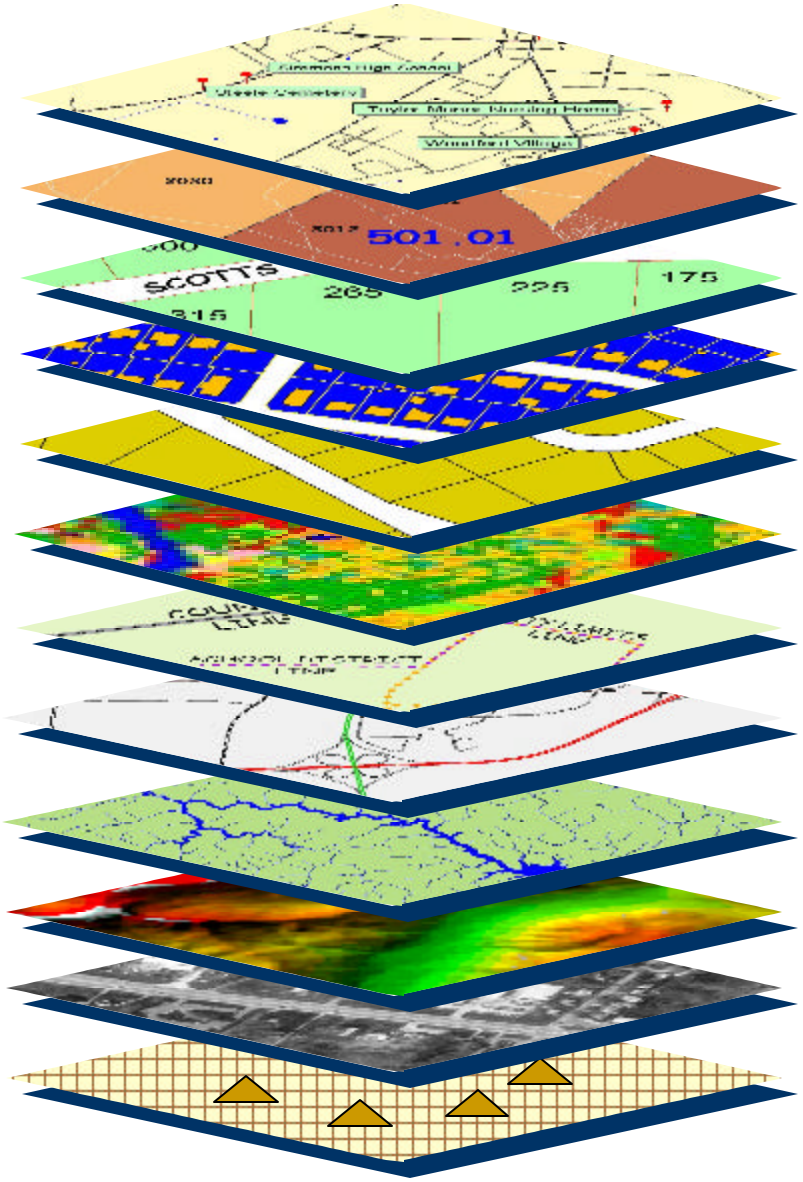


Turn on parcel and structure information—review all houses within (and near) probable location.

Only one house seems to "fit" the description (has an attic, basement, concrete block foundation, and only one bathroom).

Not "absolute" proof of location, but much better than having no idea which of the 21+ houses to consider first.

"THE COMMONWEALTH MAP"



Geographic Names*

Census

Addresses

Structures*

Parcels

Land Cover*

Boundaries*

Transportation*

Hydrography*

Elevation*

Orthoimagery*

Geodesy

*The National Map Layer

Conclusions/Observations

Implementation of FCC Phase II is not going to solve all cell phone location problems.

GIS can do much more than simply provide the basic road/address/boundary information.

Imagination is sometimes just as important as data–-but most important is the imaginative use of data.

Discussion/Questions???

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Nicole Lefever, Woodford Co Office of Land Information and Mike Soto, Office of Geographic Information, assisted in data acquisition for this presentation.